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UNIVERSITY REGISTRATION STATISTICS.

A COMPARISON of the enrolment at the institutions indicated in the table for the fall of 1905 with the figures for the previous year will show that on the whole the gains in the different institutions are not so marked as they have been in previous years; indeed, a number of prominent institutions show a decrease in attendance compared with 1904. Among these are the University of California, Columbia, Harvard, Johns Hopkins, Northwestern and Princeton. The most consistent gains have been made by the University of Pennsylvania, Syracuse and Yale in the east, and by Chicago, Illinois, Michigan and Ohio State in the west. The most pleasing feature of the development is the general desire all along the line to advance the standard of requirements for entrance, particularly in the professional schools, and in a considerable number of institutions the decrease in registration may be attributed to this factor. The daily press is still commenting upon the growth of the western institutions and calling attention to a loss in the number of students from the west attending higher institutions of learning in the east. As was pointed out by the writer in an article on the geographical distribution of the student body at a number of American universities,[1] there has in reality been no ap-

[1] Cf. SCIENCE, N. S., Vol. XXII., No. 562, October 6, 1905, pp. 424–428.

FACULTIES	California	Chicago	Columbia	Cornell	Harvard	Illinois	Indiana	Johns Hopkins	Leland Stanford, Jr.	Michigan	Minnesota	Missouri	Nebraska	Northwestern	Ohio State	Pennsylvania	Princeton	Syracuse	Virginia	Wisconsin	Yale
College Arts, Men	532	750	557	694	1898	352	493	188	907	886	470	319	263	368	266	305	629	1213	246	881	1323
College Arts, Women	943	893	371		356	376	299	.....	488	641	843	281	640	463	254	.....	.....		.....	653	.....
Scientific Schools*	764	.....	566	1499	507	880	†	.....	†	1152	576	562	566	†	766	608	624	391	110	771	1028
Law	76	133	277	220	709	144	178	.....	140	868	455	199	186	214	147	323	.....	160	189	149	277
Medicine	72	153	424	362	290	540	26	293	.....	334	191	94	105	486	.....	580	.....	151	121	.....	137
Graduate Schools	271	420	804	200	456	145	.....	160	68	123	125	92	93	49	37	287	108	65	30	258	372
Agriculture	111	.....	.....	222	27	350	.....	.....	.....	.....	800	97	154	.....	208	.....	.....	.....	.....	142	.....
Architecture	12	.....	107	81	‡	110	.....	.....	.....	.....	.....	.....	.....	.....	10	123	.....	44	.....	.....	.....
Art	165	.....	.....	.....	‖	14	.....	.....	.....	.....	.....	†	49	.....	.....	.....	.....	107	.....	.....	49
Dentistry	76	.....	.....	.....	86	144	.....	.....	.....	130	181	.....	.....	391	.....	325	.....	.....	.....	.....	.....
Divinity	.....	177	.....	.....	36	.....	.....	.....	.....	.....	.....	.....	.....	256	.....	.....	.....	.....	.....	.....	88
Forestry	**	.....	.....	.....	‡	.....	.....	.....	.....	.....	.....	**	.....	.....	17	.....	.....	.....	.....	.....	57
Music	†	.....	32	.....	‖	88	.....	.....	.....	.....	.....	††	320	336	.....	38	.....	618	.....	229	85
Pedagogy	†	163	792	.....	‖	‡‡	.....	.....	.....	.....	.....	207	.....	.....	.....	.....	.....	†	.....	65	.....
Pharmacy	82	.....	353	.....	.....	172	.....	.....	.....	69	75	.....	.....	167	50	.....	.....	.....	.....	31	.....
Veterinary	.....	.....	.....	88	.....	.....	.....	.....	.....	.....	.....	**	.....	.....	114	100	.....	.....	.....	.....	.....
Other Courses	.....	168	.....	199	.....	38	.....	47	.....	82	14	.....	200	114	45	621	.....	44	.....	.....	.....
Deduct Double Registration	.....	(175)	(266)	(1)	(15)	.....	.....	.....	.....	(201)	.....	(226)	(72)	(95)	.....	(8)	.....	(70)	.....	(434)	(177)
Total	3104	2682	4017	3564	4350	3353	996	688	1603	4084	3730	1625	2504	2749	1914	3302	1361	2723	696	2745	3239
Summer Session (1905)	795	2293	1018	619	1076	423	622	.....	33	690	210	396	211	194	296	214	.....	88	.....	531	288
Deduct Double Registration	(268)	(418)	(280)	(312)	(143)	(141)	(241)	.....	(30)	(253)	.....	(134)	(80)	(152)	(153)	(86)	.....	(35)	.....	(193)	(50)
Grand Total, 1905	**3631**	**4557**	**4755**	**3871**	**5283**	**3635**	**1377**	**688**	**1606**	**4521**	**3940**	**1887**	**2635**	**2791**	**2057**	**3430**	**1361**	**2776**	**696**	**3083**	**3477**
" " 1904	3738	4035	4833	3833	5392	3369	1206	740	1424	4000	3886	1704	2728	2856	1758	3027	1385	2452	691	3370	3008
" " 1903	3690	4146	4557	3438	6013	3239	1614	694	1370	3926	3550	1540	2513	2740	1710	2644	1434	2207	.....	3221	2990
" " 1902	3676	4296	4156	3281	5468	.....	1648	669	1378	3764	3505	1408	2560	2875		2549	1345	2020	.....	2884	2804
Officers	364	316	573	480	569	396	80	173	145	305	231	148	168	345	160	345	157	207	83	271	414

* Includes schools of chemistry, engineering, mining and related departments.

† Included in college statistics. ‡ Included in scientific schools.

‖ Not a separate school; courses taken by undergraduate and graduate students in college or scientific school and graduate school, respectively.

** Included in agriculture. †† Included in pedagogy. ‡‡ 92 students included in other departments.

preciable falling off in the percentage of western students in attendance on eastern institutions, and this statement is borne out at Yale, for example, this year, the university reporting gains in the west and northwest, and the same increase holds true for Columbia. In the case of the latter institution, the erection of dormitories is no doubt partly responsible for this growth in the number of students hailing from the middle and far west. Unquestionably the low tuition fees at the western state institutions are responsible in large measure for the consistent gains made by most of these institutions in the matter of attendance.

The statistics given on page 730 are, with minor exceptions, approximately as of November 1, 1905, and relate to the registration at twenty-one of the leading universities throughout the country. I wish again to point out that the higher institutions here represented are not the twenty-one largest nor the twenty-one leading universities of the country. The figures have in every case been secured from the proper officials of the university concerned. At the majority of the institutions the final enrolment at the close of the year will no doubt be in excess of the figures given in the table, but changes of this nature made in the course of the academic year are as a rule not of sufficient magnitude to influence the general result. A number of newspapers have published comparative tables this fall which have been thoroughly misleading, inasmuch as they were based upon returns that were altogether too early. To mention just one illustration, an article in the Boston *Transcript* for October 14, 1905, enumerated the American universities having the largest student enrolment (exclusive of the summer session registration) in the following order: Michigan, Harvard, Minnesota, Columbia, Pennsylvania, California, Yale, Cornell, etc.; whereas the later figures show that it should have been Harvard, Michigan, Columbia, Minnesota, Cornell, Illinois, Pennsylvania, Yale, etc.

According to the figures of 1904, the twenty-one universities included in the comparison ranked as follows: Harvard, Columbia, Chicago, Michigan, Minnesota, Cornell, California, Wisconsin, Illinois, Pennsylvania, Yale, Northwestern, Nebraska, Syracuse, Ohio State, Missouri, Leland Stanford, Princeton, Indiana, Johns Hopkins and Virginia. Comparing this with the 1905 order, we notice that there has been no change in the relative positions of the six universities having the largest total enrolment, that is, counting in the summer session registration. Illinois, however, has passed California, although the registration at the two universities is practically identical. The fact that Yale has passed the University of Pennsylvania is due to the establishment of a summer session at the former institution, but there is very little difference in the enrolment of the two universities. The Wisconsin figures for this year do not include the dairy students and short-course students in agriculture, which were included in previous years; this does not, however, affect the relative standing of the institution as to numbers. Northwestern occupies its old position and Syracuse has passed Nebraska. Ohio State, Missouri and Leland Stanford occupy the same relative positions as last year, while Indiana has passed Princeton, although the difference in enrolment of the two institutions is quite small. Omitting the summer session registration, the order would be as follows: Harvard, Michigan, Columbia, Minnesota, Cornell, Illinois, Pennsylvania, Yale, California, Northwestern, Wisconsin, Syracuse, Chicago, Nebraska, Ohio State, Missouri, Leland

Stanford, Princeton, Indiana, Virginia and Johns Hopkins. It is to be hoped that none of the universities included in the table is entering into competition with its fellows for mere numbers, and I trust that this article will not be interpreted by the reader as desiring in any way to lay stress upon the factor of numbers as the most important item in the development of a higher institution of learning. Nevertheless, the figures reflect certain important features of the manner of expansion of prominent American universities, and viewed from this standpoint, they are no doubt of value.

Examining the different faculties, we are struck at once by the continued decrease in attendance at the medical schools throughout the country, a loss that can not be explained by increased admission requirements alone. Unquestionably the reasons stated in a previous article must also be taken into consideration.[2] Numerous reports indicate that in France especially the supply of physicians is far in excess of the demand. The only increase of note at any of the medical schools enumerated in the table is at that of the University of Pennsylvania, where the faculty of medicine shows a gain of 33 students, making the Pennsylvania medical school the largest in the list, Illinois being second, Northwestern third and Columbia fourth. One half of the law schools show a gain, whereas the other half have experienced a loss in attendance. The law school of the University of Michigan is by far the largest of those mentioned in the table, Harvard still being second, Minnesota third and Pennsylvania fourth. Columbia and Yale are apparently equal in size, but the Columbia figures do not include 24 college seniors, which would bring its total law registration to 301. The scientific schools continue to increase all along the line. At Princeton the number of scientific students is practically equal to the number of academic students, while only three years ago there were 264 more academic than scientific students. At Yale, too, the number of scientific students is increasing rapidly, and the difference between the number of academic and scientific students has been reduced from 445 to 295 during the past three years. At the same time, it should be pointed out that the increase in the scientific schools is not quite as marked in a number of institutions as it has been in previous years, yet if the present rate of increase should continue, the time will no doubt come when the supply of students equipped for technological work will exceed the legitimate demand. The Massachusetts Institute of Technology shows a falling off in enrolment this year compared with the corresponding date last year. The statement occasionally made, sometimes more in jest than in earnest—especially in connection with the coeducational institutions in the middle west—that the large increase in the number of women students in the academic department is causing men to flock to the scientific schools in these institutions, is no doubt founded upon fact in more than one instance. Cornell still leads in the number of scientific students, Michigan being second, Yale third and Illinois fourth, and Harvard continues to have the largest academic enrolment. Its summer session was also the largest last year (leaving Chicago out of consideration), Columbia's being second, California's third and Indiana's fourth. The Columbia figures are exclusive of the scientific students registered for summer work in surveying, geodesy, etc., away from the university. Columbia, with an enrolment of 804 stu-

[2] Cf. SCIENCE, N. S., Vol. XVIII., No. 467, December 11, 1903, p. 741.

dents in the graduate faculties, easily maintains the lead in this department which it has held for several years, Harvard, Chicago and Yale following in the order given. Northwestern has the largest dental school, with Pennsylvania second, and the former institution possesses the largest divinity school. The greatest number of music students is enrolled at Syracuse, and the Columbia school of pharmacy is more than twice as large as that of its closest numerical competitor, Illinois. The largest veterinary college is at the Ohio State University, and by far the largest school of agriculture is found at the University of Minnesota, the number of agricultural students at the University of Illinois being 100 less than one half the number of those at Minnesota. The gains that have been made by the schools of agriculture all over the country are worthy of especial mention. As far as is known, instructors in summer schools who are not also counted in the regular academic year of 1905–06 are not included under officers. Of these there were no less than 47 in the Harvard summer school, which would bring the Harvard officers' total to 616.

Taking up the different institutions given in the table in alphabetical order, we note that there has been a slight decrease in the enrolment at the *University of California*, a decrease affecting the summer session as well as the regular term. In the academic department there has been a slight gain and in the scientific schools a slight loss. In the undergraduate departments of the university advanced matriculation requirements were put into effect for the first time this fall. The chief of these new requirements was the addition of French and German to the requirements for admission to all of the engineering colleges and the addition of geometrical drawing to the regular requirements of these colleges. This year, also, the university for the first time required that all candidates for teachers' recommendations shall spend at least one half-year in the graduate school (after receiving a baccalaureate degree) before receiving their recommendations as teachers. This latter requirement has resulted in a considerable increase in the number of graduate students (from 194 to 271), and it may also have resulted in some loss in the number of undergraduate students, by reason of the fact that prospective teachers may have gone directly from the high schools to the normal schools for their professional training. The professional schools of law and medicine both show a falling off, which is especially marked in the school of medicine, where the decrease has been one from 106 to 72. A year ago there were 33 first year men in medicine, as against 9 this year, the large falling off in their number being due to the fact that beginning with this year no students were admitted to the medical school who did not possess the equivalent of two full years of regular work in a college or university. Although the requirements for matriculation in the college of agriculture were this year advanced so as to equal the requirements for the other schools of the university, there has been a decided gain in the number of new students, an increase that we shall note in connection with all of the other institutions on the list, with a single exception. The dental school shows a slight loss and the school of pharmacy a small gain. The summer session shows a falling off from 913 to 795. Of the 3,631 students at the University of California, 1,872 are men and 1,759 are women.

The fall enrolment at the *University of Chicago* shows a considerable increase over that of last year, whereas the gain in the summer term of the university is not so marked. The college department shows a

considerable increase in the number of students, both men and women, and there have been gains also in law, medicine, divinity, pedagogy and in the graduate schools. The 168 students mentioned under 'other courses' are enrolled in the course in railway instruction, which was begun during the winter of 1904–05. Through an oversight, the number of officers of the university was incorrectly stated last year. The total number given this year includes the actual administrative officers and instructors, but no officers engaged merely in extension work or in affiliated institutions. Of the 4,557 students, 2,332 are men and 2,225 are women.

Columbia University shows a slight decrease in enrolment over the previous year, due largely to increased requirements in the professional schools of law, medicine and pharmacy. The academic department shows a considerable gain over the preceding year and reports the largest entering class (157) in its history. This increase may be attributed to several causes, the chief of which is the adoption of a new program of studies, which provides for the degree of B.S. as well as for the degree of A.B. Among the important innovations in the new program the following may be mentioned: Beginning with September, 1905, one half year instead of the whole year is made the unit of credit, the term 'point' signifying the satisfactory completion of work requiring attendance one hour a week for one half year, and the requirement for graduation being 124 points; at least 9 points, exclusive of prescribed work, must be made before graduation under some one department; in any half-year not more than one course in which the student is marked D (poor) may be counted towards a degree; a failure in any prescribed course calls for a repetition of the course; the mark A (excellent) in any two courses entitles the student to one point of extra credit, provided he has not fallen below the mark B (good) in any of the courses pursued by him during the half-year; a candidate for the degree of A.B. or B.S. must fulfil all requirements for the degree within six years from the time of his first matriculation as a freshman, whether at Columbia or elsewhere; every recipient of the degree of A.B. or B.S. must have made at least 84 points in actual college residence, of which no less than 24 points must have been made in Columbia College; when 72 points (including all prescribed work) have been made, a student may—under certain conditions—take the studies of the first year of the schools of applied science, of the college of physicians and surgeons, of the professional course of Teachers College or in the school of fine arts, and receive the degree of A.B. or B.S. upon the satisfactory completion of two years' work in the professional course; when 94 points, including all prescribed work, have been made, and of these not less than 72 in Columbia College, the student may take the studies of the first year of the school of law, and receive the degree of A.B. or B.S. upon the completion of one year's work in this school. A detailed statement of the new program of studies can be found in the article contributed by Professor Calvin Thomas to the *Educational Review*, April, 1905, and to the *Columbia University Quarterly*, June, 1905. It will be seen from the brief summary given above that students graduated from the public high schools of the city in February are now enabled to enter Columbia College at once, instead of waiting until the following September. The new regulations will also permit a student to graduate in three or three and one half years, instead of in four years, which has been the normal time heretofore. The summer session is becoming more and more

an integral portion of the regular course, and the number of students taking advantage of this medium to shorten the length of their course is constantly on the increase. Another factor that unquestionably entered into the growth of the college is the completion of the two dormitories, Hartley and Livingston Halls, which accommodate about 600 men and which will no doubt work a revolution in the life of the undergraduate student body. Five hundred thousand dollars has recently been presented by an anonymous donor for the erection of a building (Hamilton Hall) to be used by the college. This building is to be ready for occupancy in September, 1906, and will no doubt contribute its share to the growth of the college. Barnard College, the undergraduate faculty for women, shows a slight gain over last year. In the scientific schools there has been a small loss, due to the stricter enforcement of requirements for advancement, but this loss has been more than made up by the gain in the school of architecture, where there has been a considerable increase on account of the introduction of the *atelier* system and of a new course leading to a certificate in architecture instead of to the B.S. degree. All three classes in the law school are composed for the first time of holders of baccalaureate degrees (leaving college seniors out of consideration), and the result is that there has been a considerable falling off in the attendance. The enrolment in the first year class, counting college seniors, is 94. The school of medicine also shows a large decrease, due to the increased requirements that first became operative two years ago. The new requirements did not affect this year's graduating class, so that the attendance next year promises to be even smaller than it is this year. The entering class consists of 92 men, counting the college seniors. The college seniors are not included in the figures for law and medicine given in the table. In the school of pharmacy there has been a loss of 82. Last year the attendance in this faculty was unusually large, on account of the desire to register as a student of pharmacy before the new statute increasing the requirements for admission to schools of pharmacy became operative. The increased requirements went into effect this fall, with the result that the entering class is considerably smaller than it was last year. The graduate schools show a growth from 709 to 804, and Teachers College has experienced a remarkable increase, namely, from 627 to 792. The summer session in 1905 was larger than the preceding one, but the increase was more than offset by a greater gain in the number of summer session students who returned for work in the fall, there being 280 this year as against 184 last year, thus emphasizing the statement made before, that the summer session is being regarded more and more as an integral portion of the regular course of study.

At *Cornell University* there has been a slight gain in the academic department and a considerable increase in the scientific schools. The law school has remained stationary, the medical school and the veterinary school show a decrease, while the graduate department and the school of agriculture show a gain, which is especially noticeable in the case of the latter faculty. The enrolment in the short winter course in agriculture has increased from 135 to 199. Of the 1,499 students enrolled in the scientific schools, 1,082 are registered in the department of mechanical engineering (Sibley College) and 417 in the department of civil engineering. The summer session shows a falling off compared with the previous year, and here, as at Columbia, there has been an increase in the number of summer

session students returning for work in the fall. Several new regulations covering students' fees have recently been adopted. For the first time a matriculation fee of $5 was required of all new students this fall, and the graduation fee has been increased from $5 to $10 and the fee for advanced degrees from $10 to $20. The tuition fees in all courses in the colleges of mechanical and civil engineering have been increased from $125 to $150 per annum. The entrance requirements in engineering have been raised so as to include advanced work in both modern languages, or their equivalent, and this may have contributed to the fact that the departments in question do not show as large gains as they did last year. The number of women students in the university shows an increase for the first time in several years, and this increase probably explains in some measure the gain in attendance in the academic department, in which nearly all of the women students are enrolled.

The total attendance at *Harvard University* shows a decrease of 109, to which the summer session did not contribute. In the college department there has been a loss of 107 men, while Radcliffe College shows a slight increase. The scientific schools, as well as the professional schools of law, medicine, dentistry and divinity, show a falling off in enrolment, while the graduate schools and the department of agriculture show slight gains. The medical school of the university has again raised its standard for entrance by requiring a knowledge of organic chemistry. The full requirements now call for a certificate that the student has passed in one year's full work in organic chemistry, a certificate that he has passed in qualitative analysis, and a college degree. In spite of this fact, there is an increase of ten in the entering class, the first upward step since the requirement of a degree for admission. At Harvard, as at Columbia, the number of high school graduates in the academic department seems to be larger than ever and there is an accompanying decrease in the number of graduates of private preparatory schools. Of the total number of students registered at Harvard University, 4,382 are men and 901 are women.

At the *University of Illinois* there has been a considerable increase in the grand total, but the increase aside from the summer session is also quite marked. The largest growth is shown by the scientific schools and the law school; the number of men in the academic department has remained stationary, whereas there has been an increase of 51 in the number of women in the same department. The enrolment in the school of medicine has decreased from 629 to 540, thus reflecting the falling off in the number of medical students all over the country, to which attention has frequently been called by the writer. The graduate schools, the school of pharmacy and the school of agriculture show slight gains, whereas there has been a falling off in dentistry and music. The students mentioned under 'other courses' are enrolled in the library school, which offers a five-year course leading to the degree of B.L.S. Of the 3,635 students registered at the University of Illinois, 2,898 are men and 737 are women.

The enrolment in the *University of Indiana* shows an increase in the fall registration as well as in the summer session. There is a total enrolment of 1,377 students, of which 862 are men and 515 are women.

At *Johns Hopkins University* there has been a decrease in enrolment of about 7 per cent., for which no definite reason can be assigned. The academic department and the faculty of medicine have remained

stationary, and the falling off has taken place in the graduate schools. The 47 students under 'other courses' are enrolled in medical courses for physicians, and here also there is a decrease over the previous year. Of the 688 students at Johns Hopkins, 658 are men and 30 are women.

The total registration at *Leland Stanford University* shows a decided increase, which is found primarily in the academic department. The graduate schools show a loss of 21. The figure given for the law school last year was 187, but as a matter of fact the law registration this year is larger than it was in 1904. Last year the total number of law majors was given, whereas this year only those students are included who are actually taking law work. The number of law majors this year is 270. The total enrolment at Leland Stanford University is 1,606, of which 1,105 are men and 501 are women.

Statistics of the registration at the *University of Michigan* as of October 24, published in the November issue of the *Michigan Alumnus*, show that there has been an absolute gain of 409 students over the number matriculated at the corresponding date last year. This gain of 13 per cent. is indeed a remarkable one, and the increase at this university has been larger than at any of the other institutions in the list. By far the greatest increase occurred in the literary and engineering departments, and the medical school is the only one that shows a decrease, which may be ascribed to increased requirements, as well as to the fact that the number of students taking the six-year combined literary-medical course is increasing each year. The 82 students under 'other courses' are enrolled in the homeopathic medical school. The so-called deferred degree or combined course plan, which was instituted at Columbia University, is gaining in favor every day, and it seems to solve better than any other the problem of shortening the combined college and professional course, giving, as it does, academic recognition to the collegiate side of the combined course and at the same time maintaining the traditional college course for those students who do not intend to enter a professional school. The enrolment in the Michigan summer session shows a slight gain over that of the preceding year. Of the 4,621 students, 3,794 are men and 827 are women.

The *University of Minnesota* shows a gain over last year. The number of men in the college has remained stationary, whereas the number of women has been increased by 68. The scientific schools show a slight increase, but the professional schools of law and medicine both show a decided falling off in attendance. The graduate schools have lost a few students, while agriculture, dentistry and pharmacy show gains, which are especially noticeable in the former two schools. The summer session has remained stationary. The 14 students under 'other courses' are enrolled in the homeopathic medical college. The total enrolment is 3,940, of which 2,682 are men and 1,258 are women.

The attendance at the *University of Missouri* has increased, the total gain in the fall registration, that is, exclusive of the summer session, amounting to 89. In the academic department there has been an increase in both men and women. The scientific schools have also gained, but the professional faculties of law and medicine show a falling off. The graduate schools and the school of pedagogy show an increase. The first item of double registration is unusually large, inasmuch as many students are taking the six-year combined academic and professional courses, and are therefore registered in two schools. While the figures show an increase in most of the

departments and in the total registration, it should be noticed that a threatened typhoid-fever epidemic in Columbia at the beginning of the regular session caused a number of students to transfer to other institutions. Of the total number of students in the University of Missouri, 1,388 are men and 499 are women.

Inasmuch as the figures given last year for the *University of Nebraska* were those of the academic year 1903–4 and not those for the beginning of the academic year 1904–5, no accurate comparison can be made. The enrolment given in the table for 1902, 1903 and 1904 represents the final figures for the close of the respective academic years, and the total of 2,635 for November 1, 1905, will no doubt be increased to approximately 2,800 by the close of the year, thus showing a slight gain in the total registration over last year. The 200 students mentioned under 'other courses' will probably be enrolled in the short course in agriculture, their number being only estimated. The increase in registration has occurred in the scientific schools and in the departments of law and agriculture. Medicine shows a decided falling off. Of the 2,435 students enrolled, (*i. e.*, excluding the prospective enrolment in the short course in agriculture), 1,275 are men and 1,160 are women.

Northwestern University shows a slight decrease over last year. There has been a considerable gain in the academic department and in the theological school, and smaller gains in the law school and the school of music. No particular reason can be ascribed to the decrease in the medical school; it seems merely to reflect the decrease in the number of medical students that has been noticed for several years throughout the country. The marked decrease in the dental school is due to the graduation of an unusually large class in June, a class which had been carried for three years and which was abnormally large, because of the fear that the length of the course might be increased to four years. Three years ago the entering class in the dental school was two or three times as large as might naturally have been expected, and the following class was proportionately small. The registration of the first-year men in the school this year has been considerably larger than was anticipated. The decrease in the school of pharmacy is apparently due to an advance in the admission requirements by the addition of one year of high school credit. Northwestern University has a total registration of 2,791 students, of which 1,998 are men and 793 are women.

Ohio State University shows a decided gain over last year, in which the scientific schools have a considerable share; although the academic department also shows an increase in both men and women. The law school, the graduate schools and the school of forestry show a decrease, whereas agriculture, pharmacy and the veterinary school show an increase. The enrolment at the summer session has almost tripled. The total registration at the university is 2,057, of which 1,645 are men and 412 are women.

The increase in the enrolment at the *University of Pennsylvania* is quite striking; indeed, the increase in the total number of students is the largest in the history of the institution. Every department except the dental school shows a gain over last year, and notwithstanding the fact that the fees in all departments have been slightly raised, all the entering classes show a considerable increase, even in the dental school, where $60 per year has been added to the tuition. An innovation in the payment of tuition fees in the college has been announced by the university au-

thorities. The tuition in the academic department has been fixed at $150 a year, whereas during the past few years every student was required to pay $10 for every unit of work taken by him, sixty units being necessary for the degree. The 621 students mentioned under 'other courses' are distributed as follows: 303 are enrolled in the evening school of accounts and finance, 278 in the school of finance and commerce and 40 in biology. The figures for last year included 155 students under the heading Teachers College. This year there are 226 students enrolled in special Saturday courses for teachers, but they have been excluded from the table, inasmuch as similar students are not counted in the Columbia and Harvard figures.

Princeton University has experienced a slight decrease in enrolment, although the freshman class shows a gain. The academic department has decreased from 665 to 629, whereas the scientific schools have lost only 4 students. There has been a slight gain in the graduate schools.

Syracuse University continues to make the consistent gains that it has shown during the past few years and these gains are visible all along the line, except in the faculty of medicine.

The total enrolment at the *University of Virginia* has remained stationary to all intents and purposes, although there have been changes in different faculties. The professional faculties of law and medicine both show a falling off, which is especially noticeable in the case of medicine.

The *University of Wisconsin* apparently shows a decrease in the total registration, whereas in reality there has been a slight gain, inasmuch as the dairy students and short-course students in agriculture are not included in this year's figures. The large number under the first item of double registration is due to the fact that the classification at the University of Wisconsin is based upon a somewhat different plan from that followed in the accompanying table. The school of pharmacy and the pedagogical course are included in and are a part of the college of letters and science, and the same is true of the students in the graduate school; where the latter are taking work in engineering or in agriculture they are classified as graduate students in these courses and are included in the total attendance of the college, so that the total in the college of arts includes the graduate students in that college, as well as the students in pharmacy and pedagogy. The total number given in the graduate school includes graduate students taking work in the college of letters and science, the college of engineering and the college of agriculture. There has been a slight decrease in attendance in the college of engineering and the school of law, a decrease that is accounted for by advanced entrance requirements that became operative in these colleges this fall. For admission to the school of law the candidate is now required to have had at least one year's attendance in college in addition to the regular entrance requirements. In engineering increased requirements in mathematics have gone into effect. The increase in the attendance at the summer session is worthy of note, for there were 136 more students in 1905 than in 1904. Of the total students enrolled, 2,170 are men and 913 are women.

The total registration at *Yale University* shows a decided increase over last year, which may be attributed in some measure to the fact that the first summer session held by the university was opened in July, 1905. It has been impossible to obtain the correct figures under the second item of double registration and it was necessary to make an estimate, which no doubt comes

near the truth. All of the departments, with the exception of medicine, divinity and forestry show an increase. The enrolment in the Sheffield Scientific School has increased from 774 to 1,028, although it should be pointed out that graduate students in science were not included in the Sheffield figures last year, whereas they have been included in this year's table. The final registration is likely to carry the number of freshmen in the scientific school beyond that of the academic freshman class, which is an epoch in the history of the departments. The scientific freshman class is so large that it has had to be divided into twelve divisions instead of ten, as last year. In six years the size of the entering class in the scientific school has risen from 199 to about 400, an increase of over 100 per cent.

The general development of higher education in the United States as reflected in the accompanying tabulation is one that may well give rise to gratification, and it is hoped that the prominent exponents of higher education in this country will vie with one another in constantly increasing the quality of their work and the value of their equipment, instead of laying undue stress on any figures that do not reflect a corresponding development in academic standards and ideals.

Rudolf Tombo, Jr.,
Registrar.

Columbia University.

THE ANNUAL REPORT OF THE SECRETARY OF AGRICULTURE, 1905.

The secretary says that it is in the highest degree gratifying to present evidence of the unprecedented prosperity which has in recent years rewarded the diligence of the farmer and the efforts of his department. A year of unequaled prosperity has been added to the most remarkable series of similar years that has come to the farmers of this country. Farm crops have never before been harvested at such a high general level of production and value. Corn has reached its highest production, over 2,700,000,000 bushels, of a total estimated value of $1,216,000,000. Hay comes second, with a value of $605,000,000. Cotton is expected to yield $575,000,000. The short wheat crop of last year is followed by one of 684,000,000 bushels, and its value, $525,000,000, overtops the highest value ever before reached. While only one crop, corn, reached its highest production this year, four crops—corn, hay, wheat and rice—reached their highest value.

No crop but corn produces the income that the dairy cow does. The estimate of the value of dairy products for 1905 reaches $665,000,000. The farmer's hen competes for precedence with wheat, poultry products aggregating half a billion dollars in value.

The wealth production on farms in 1905 has reached the highest amount ever attained by the farmer of this or any other country, 'a stupendous aggregate of results of brain and muscle and machine,' amounting in value to $6,415,000,000, an excess over last year of $256,000,000. The wealth produced on farms in 1905 exceeds that of 1904 by 4 per cent., that of 1903 by 8 per cent., and that shown by the census figures for 1899 by 36 per cent. Should there be no relapse from his present position as a wealth producer, three years hence the farmer will find that the farming element, about 35 per cent. of the population, has produced an amount of wealth within ten years equal to one-half of the entire national wealth produced in three centuries.

The value of horses and mules on farms exceeded last winter $1,452,000,000. Milch cows are advancing in numbers and are worth $482,000,000. The value of all other cattle is estimated at $662,000,000. Sheep are declining in number and total

value, while swine maintain their previous position, and are valued at over $283,000,000. In the aggregate, the value of farm animals of all sorts has increased over that given in the census of 1900 by 9 per cent.

During the last fiscal year, exported domestic farm products were valued at $827,000,000. This is below the annual average for the five years preceding, and the relative position of farm products in domestic exports is a declining one on account of the gain in exports of manufactures. Nevertheless, during the last sixteen years the domestic exports of farm products have amounted to $12,000,000,000, or $1,000,000,000 more than enough to buy all the railroads of the country at their commercial value, and this with the mere surplus for which there was no demand at home. During these sixteen years the farmer has secured a balance of $5,635,000,000 to himself, out of which he has offset an adverse balance of $543,000,000 in the foreign trade in nonagricultural products, turning over to the nation, from his account with other nations, $5,092,000,000. The exports of forest products were $63,000,000.

Computations based upon census information show that farm products constitute 56.4 per cent. of the total products of the country, and 86.8 per cent. of the total materials of industries utilizing agricultural products as materials. During the last census year farm products employed in manufactures were valued at $2,679,000,000. These industries employed 2,154,000 persons, and had a capital of $4,132,000,000.

One of the most notable outgrowths of savings by farmers is the great multiplication of small national banks in recent years. As many as 1,754 banks, each with a capital of less than $50,000, were organized from March, 1900, to October, 1905. These were distributed mostly throughout the south and the north central states, in rural regions. In the south 633 of these banks were organized, and in the north central states 792. The capital of these banks has come from the farmers. The increase of bank deposits in agricultural states is most extraordinary. The increase during the year which ended June 30, 1905, in Iowa and South Dakota was 14.9 per cent.; in Nebraska, 13.5 per cent.; in Kansas, 9.7 per cent. and in North Dakota 25 per cent. During the same time bank deposits in Massachusetts increased 9.1 per cent. But still more remarkable is the bank statement for the south central states. Throughout the whole area of that division the increase was 22.8 per cent., while the general average increase for the United States was but 13.5 per cent. For the first time in the financial history of the South, deposits in the banks of that region now exceed $1,000,000,000. These remarkable increases in bank deposits in agricultural States and the increase in the number of small country banks are directly and indirectly because of the profits that have come to the farmers.

The department this year undertook, and has just completed, an investigation of the changes in the value per acre of medium farms since the census of 1900. Inquiries were addressed to 45,000 correspondents distributed throughout every agricultural neighborhood in the United States, and returns from these correspondents warrant the following statements:

During the past five years the value of medium farms in this country has increased 33.5 per cent. as compared with an increase of 25 per cent. for the ten years preceding. The increase in the south central group is 40.8 per cent.; in the western group, 40.2 per cent.; in the South Atlantic group, 36 per cent.; in the north central group, 35.3 per cent., and in the North Atlantic group, 13.5 per cent.

Figured in dollars of gain per acre, the increases during the five years past of medium farms were in the north central division $11.25; in the western division $5.36; in the North Atlantic $5.26; in the South Atlantic division $4.93; and in the south central division $4.66. The average increase for the United States was $7.31. The returns showed that farms of less intensive culture and crop have increased in value less than the farms having more valuable crops and receiving high culture. Everywhere is revealed a more intelligent agriculture. Farmers are improving their cultural methods and changing from less to more profitable crops. Other causes for higher values are better buildings, better fences, tile draining, new facilities for transportation, more railroads, and better wagon roads.

The cotton farms have increased in value $460,000,000, so that it might be said that during the past five years the cotton plantations have had six crops, one of them a permanent investment promising to pay a good return year by year. Hay and grain farms show an increase of $2,000,000,000; livestock farms a still larger gain; dairy farms $369,000,000; tobacco farms, $57,000,000; rice farms $3,300,000; fruit farms $97,000,000 and vegetable farms $113,000,000. Every sunset during the past five years has registered an increase of $3,400,000 in the value of the farms of this country. Every month has piled value upon value until it has reached $102,000,000; that portion of the national debt bearing interest is equaled by the increased value of farms in nine months, and this increase for a little over a year balances the entire interest-bearing and non-interest-bearing debt of the United States.

The secretary thus summarizes the economic position of farmers:

> If the farmers' economic position in the United States is to be condensed to a short paragraph, it may be said that their farms produced this year wealth valued at $6,415,000,000; that farm products are yearly exported with a port value of $875,000,000; that farmers have reversed an adverse international balance of trade, and have been building up one favorable to this country by sending to foreign nations a surplus which in sixteen years has aggregated $12,000,000,000, leaving an apparent net balance of trade during that time amounting to $5,092,000,000 after an adverse balance against manufactures and other products not agricultural, amounting to $543,000,000 has been offset. The manufacturing industries that depend upon farm products for raw materials employed 2,154,000 persons in 1900 and used a capital of $4,132,000,000. Within a decade farmers have become prominent as bankers and as money lenders throughout large areas; and during the past five years prosperous conditions and the better-directed efforts of the farmers themselves have increased the value of their farms 33.5 per cent., or an amount approximately equal to $6,133,000,000.

Following his introduction he refers to the fact that this is the first annual report of his third term as secretary, and on this ground he presents rather a review of the work of the department during the eight years just elapsed than the ordinary synopsis of the operations of the year.

He presents the results accomplished by the Weather Bureau for the benefit of the farmers, mariners and manufacturers, and points out that with all the development of this work the average per annum increase in the cost of the service for the past ten years is but 4.41 per cent. He emphasizes the necessity of scientific research with the view to acquiring a greater knowledge of meteorological science. With this view he established three years ago a station at Mount Weather, Va., devoted to meteorological research. He proposes that the Weather Bureau shall hereafter attain as eminent a position in the work of scientific research as it has heretofore admittedly held in practical meteorology.

Of the Bureau of Animal Industry he says that the work of fighting contagious

diseases of animals has been unremittingly carried on. The report refers in detail to the principal diseases which have been made the subject of study, and concludes that in every case the efforts of the bureau have been attended with a more satisfactory control or complete eradication. He commends highly the skill and energy which characterized the suppression of foot-and-mouth disease in the New England States in 1902 and 1903. He dwells at some length on the subject of tuberculosis and the danger of its being communicated from animals to man. Of the cattle and meat inspection he says its importance is shown by the fact that upon the government certification as to the healthfulness of animals and animal products the country depends for its access with its products to foreign markets. He deprecates the possibility of abandoning any part of this work, a contingency, nevertheless, which he foresees to be unavoidable unless adequate appropriations are promptly provided for this work.

To the Dairy Division of the Bureau of Animal Industry was assigned under the law of May 9, 1902, the inspection of materials, factories and processes employed in the manufacture of renovated butter. The results have been very satisfactory. This division has accumulated and published in the past few years a large amount of valuable information of value to the dairymen and those interested in dairy products.

The Bureau of Plant Industry is organized into eleven offices and employs over 500 persons, about 60 per cent. of whom are engaged in distinctly scientific work. The review of its investigations and treatment of plant disease shows that all important diseases have been studied with results which in many cases have enabled farmers and fruit growers to greatly diminish their losses from this cause.

In its systematic work in securing new plants and seeds from foreign countries the Bureau of Plant Industry has been highly successful. Success has also attended its work in cotton breeding, undertaken with the view to obtaining new sorts combining improved length of staple with productiveness. The secretary records the production of a new citrus fruit, the citrange, several varieties of which—the Rusk, the Willets, the Morton—have been developed. Another interesting product is the new tangelo, a hybrid of the pomelo and the tangerine.

Of the work on nitrogen-fixing bacteria the secretary says that there is yet much to be done in determining the conditions under which the use of the tubercle-forming bacteria will give the best results, but that the Bureau of Plant Industry has developed a successful method of growing and distributing them and increasing their nitrogen-fixing power.

Many intelligent boards of health and water engineers are recognizing the value of the method recommended for the destruction of algal and bacterial contaminations of water supplies.

Much has been done also in perfecting the methods for testing seeds. The farmers' attention has been called to the adulteration of field seed, and they have been invited to submit samples for testing.

The secretary records the practical establishment of Durum wheat, of which several million bushels have been exported this year, and reports highly satisfactory results with new varieties of oats and barley, and the extension of the winter grain area. The last few years have witnessed a great progress in rice growing and in beet-sugar production. Valuable information has been made available in reference to the shipment and transportation of fruit. At the Summerville tea farm 9,000 pounds of tea was the product for the past season,

and a promising tea farm has been established in Texas.

Very considerable importance is recorded in the manner of seed distribution. A special feature has been the encouragement of school-garden work thereby.

The work of the forest service has been greatly developed. Of the eleven persons employed July 1, 1898, only two were professional foresters. To-day the forest service employs 153 professional foresters out of a total force of over 800 persons. An important achievement of this service during the past few years has been to enlist the sympathy and cooperation of lumbermen and forest owners, and the secretary urges that the work of education continue until public opinion will not tolerate heedless waste or injudicious loss. In the saving of waste the service has added vastly more to the national wealth than its total expenditures during its entire history. The control of the forest reserves, embracing property worth in cash at least $250,000,000, has been transferred to the forest service. This property is administered at a cost of less than one-third of 1 per cent. of its value, which increases at the rate of 10 per cent. per annum. The service continues to afford important aid to private forest owners.

The Bureau of Chemistry has conducted important investigations relating to our cereal products and prepared meats. The latter included a systematic examination of canned goods. Its practical experiments have developed the fact that, without exception, the addition of the ordinary preservatives to foods is prejudicial to health. The secretary argues the need of protecting the public from these evil effects by legislation. The Bureau of Chemistry inspects all food products intended for export where the exporters desire such inspection, which enables them to send foods to foreign countries with a certificate of inspection which, as a rule, is accepted. Of imported foods inspected 712 out of 3,576 invoices were of a character forbidden by law. Elaborate studies have been made of insecticides, in cooperation with the Bureau of Entomology, and also of materials furnished under contract to the United States government. In this work the Bureau of Chemistry has cooperated considerably with other departments of the government.

In spite of the activity of the survey force of the Bureau of Soils, there are on file at the present time requests for mapping 215 counties in 40 states and territories. The bureau has made a special study in regard to the alkali soils and into the problem of soil fertility. In this work the problems encountered in the field depend for their final solution on the work in the laboratory. The purpose of the soil survey is to indicate the most economical method of securing the best results in handling the various soils and in the production of food products from them. The surveys already made aggregate 63,000,000 acres in 44 states and territories. The soils adapted to special crops such as the grape, the apple, citrus fruits, the sugar-beet, alfalfa, rice, corn, cotton, etc., have all been made subjects of special study based on the field surveys. The demands for reports of the surveys are numerous and varied, all classes seeming to be interested in them. The investigations of this bureau into the question of soil fertility and manurial requirements have attracted general attention and much comment. As the bureau's methods of investigation are becoming more thoroughly understood they are being gradually adopted for scientific work by investigators outside of the department. Much practical work has been done in the reclamation of alkali lands. Important work in regard to tobacco has been continued in Texas, Ohio, Virginia and Connecticut. The secretary recommends in-

vestigations of the same kind in the tobacco districts of several other states.

In discussing the work of the Bureau of Entomology considerable space is devoted to the Mexican cotton boll weevil, in the work against which this bureau has had the active cooperation of the Bureau of Plant Industry. It is also cooperating with the Louisiana Crop Pest Commission and the Texas Experiment Station. The subject of dissemination of the weevil through cotton gins has been very carefully investigated, and important results have been obtained, resulting in recommendations to the ginners calculated to greatly reduce this danger.

Of recent years important work has been done by the Bureau of Entomology in the introduction of the fig fertilizing insect of South Europe, the introduction of a parasite of the black scale so injurious to citrus and olive crops in California from South Africa, and the introduction with success in the southern states of a parasite of the San Jose scale from China. Useful insects are also sent abroad at the request of foreign departments of agriculture.

Fruit growers in California and other states testify that their operations have been rendered much more profitable through the information derived from the investigations of insects injurious to fruit. The insects damaging forests, injuring stored fruits, carrying diseases, affecting live stock, and injuring field crops have all been the subject of study by the entomologists of the department.

In 1902 the Bureau of Entomology undertook once more a systematic effort to introduce the culture of the domestic silkworm into the United States. Guaranteed eggs were purchased in Italy, skilled reelers were brought over from France, and mulberry trees were distributed to persons desiring to experiment.

Much emphasis is laid upon and considerable information is given as to the saving from insect losses resulting from the work of the Bureau of Entomology. The actual loss to agriculture through injurious insects is almost beyond computation.

The work of the Bureau of Biological Survey includes the determination of the boundaries of the natural life zones of the United States and the corresponding crop zones. The chief purpose is to ascertain the boundaries of natural life zones with a view to aiding the farmer in selecting crops best adapted to his locality and in avoiding crops unsuited to it.

One section of the Biological Survey is engaged in the study of birds and their various relations to man, especially to determine whether birds damage crops, whether they protect insects either injurious or beneficial, and to what extent they feed upon weed seeds. Thousands of birds' stomachs are examined in gathering facts on this subject.

Other duties of the Biological Survey are the supervision of game protection and introduction assigned to the Department by Congress. Through cooperation with the Department of Justice and with game officials throughout the United States 166 violations of the Lacey Act were investigated and 49 convictions have resulted. Railroad and express companies have lent cordial cooperation in securing a more rigid observance of the game laws.

In discussing the work of the Division of Publications the secretary points out that the terms of the law requiring the department to diffuse information of value to agriculture are mandatory, and the most economical and available means of diffusion is through publication. He maintains that this work has been conducted with due regard to economy, and that every precaution has been taken to lessen the waste inevitably attendant upon any system of gratuitous distribution. Of the more than

twelve million copies of all publications distributed by the department during the past year nearly 45 per cent. were distributed through senators and representatives in congress, over which distribution, of course, the secretary has no control. He notes with approval a growing demand for the department publications from institutions of learning and other agencies interested in agricultural education.

Referring to the work of the Bureau of Statistics, the secretary says that the development of organizations to fix prices, and in some cases to force temporary changes giving unnatural advantages to price manipulators, has led to the need for a strong and impartial agency to make comprehensive reports of actual facts relating to prospective crops and yields, that all concerned may know how to buy and sell. He describes the various processes of crop reporting, the conditions under which, and the methods by which the reports are made.

The secretary states that as the result of a gross breach of trust on the part of one of the officials, an entirely new method of handling these reports is being devised, which he believes makes it practically impossible for such another breach of confidence to occur. He reports the prompt dismissal of the culpable official and the transfer of the whole matter to the Department of Justice, with a view to the prosecution of the guilty party. He expresses regret that while the department handled the case of its own official with vigor and promptness, no corresponding action has so far reached the traders' end of the line.

Where gamblers interested neither in production nor in consumption disturb values to the injury of both and make loud outcry when creatures of their kind bribe officials to betray confidence for the love of money, the responsibility for this leak is shared by every one who to get money without work gambles in farm products. When this form of industry ceases, he adds, these parasites who tempt department officials will have to work for their bread.

He reports the assignment of Assistant Secretary Hays to take charge of the work of the Bureau of Statistics for the present.

Of the Division of Foreign Markets, the secretary says one of its useful lines of investigation in behalf of exporters has been an examination of conditions found in countries which have a surplus in certain agricultural products which meet those of this country in common markets. Another useful undertaking has been to ascertain in detail the quantities and values of the agricultural imports of countries receiving a large share of such imports from the United States. In regard to the possibility of a foreign cotton competition, the inquiries of the department do not reveal that it has any reasonable immediate prospects, and he believes that if such competition is to arise, it will be as the result of years of effort and development. Most of the countries wherein a new production is admitted, moreover, produce a non-competing variety like the Egyptian.

Of the library the secretary reports the present quarters to be inadequate for housing its collection of 87,000 books and pamphlets. In addition to space for this valuable possession of the department, the protection from fire is an urgent need. Such protection he anticipates will soon be provided by the new building. The library is found available for information to be given in response to inquiries from all parts of the country, and much valuable material is added to its files through the foreign exchange system.

The work of the Office of Public Roads is primarily educational in character. Its province is to detail experts to give information and advice. In many communities it is found advisable to supplement advice by practical demonstration of effective road building. The total number of ex-

perimental and object-lesson roads built under the direction of this office since its organization is 96, with a total length of about 39 miles. These roads were built in 38 states. The secretary proposes to utilize the services of the greatly increasing corps of highway engineers and experts of the office wherever practicable in the construction and maintenance of roads in the forest reserves. In order to secure engineers with the necessary technical training and to supplement such training by special work for highway engineering, graduates of reputable engineering colleges are appointed as civil engineer students in the Office of Public Roads. The work of such students is of great assistance to the office, besides being of practical value to the public. The secretary believes that highway engineering should receive greater attention at the present time in the colleges. A Division of Tests has been organized in the office, primarily to test road materials, but the equipment necessary for this purpose has been also available for testing other materials of construction, such as steel wire for fences, concrete posts, etc.

The work of the Office of Experiment Stations has greatly increased during the past eight years. Through this office the secretary exercises a certain supervision of the federal funds granted to the experiment stations. He says that the stations have been not only a benefit in making the department's work more effective, but that they have by their own investigations raised American agriculture to a higher plane. He expresses the hope that congress will recognize the need of providing the stations with means to meet the demands made upon them, and states that there is no direction in which public moneys can be appropriated that will bring more certain and lasting returns than in helping the state experiment stations.

To diffuse among farmers the results obtained by stations, the department undertook the publication of a series of popular resumes of practical features of the station work. Over thirty numbers have been issued as a part of the Farmers' Bulletin series. The secretary reports great activity in the development of agricultural education, and through the Office of Experiment Stations the department has taken a leading part in this work. The permanent success of agriculture, he argues, depends upon the technical intelligence and knowledge of the farmers. In this line of work the farmers' institutes, established under the authority of the various states and territories, furnish the most useful agencies. Practical benefit to the people interested is reported as the result of the establishment of experiment stations under the direct control of the department in Alaska, Hawaii and Porto Rico.

Nutrition investigations are conducted by this office and during the past eight years some 200 dietary studies have been made, and not far from 800 experiments in which the digestibility of different foods was determined with healthy men under normal conditions. It has been found as the result of some of these studies that white bread furnished the body with more protein and energy, pound for pound, than whole wheat or graham flour for the same amount of grain, any deficiency in the composition of the white flour being more than offset by its more thorough digestibility.

The irrigation and drainage investigations of the department have resulted in the systematic study of the agricultural and legal features of irrigation. Measurements of the quantity of water used in ordinary practise have been followed by more careful experiments to determine the frequency of irrigation and the amount of water to be applied to get the best results. The studies of irrigation laws have included the collection of facts showing the

character and amount of water rights. Experiments are being made to determine how far drainage can be made to protect hillsides from destructive effects of erosion. In the whole country there are 100 million acres of swamp and poor lands, which can be reclaimed only through drainage.

Of the new buildings the secretary says that the structures now being built will cost about one and one half million dollars, and should be completed in two years, by which time it is hoped that further appropriations will be available to continue the building work inaugurated.

Speaking of the growth of the department, the secretary reports the number of persons on the rolls July 1, 1905, to be 5,446. Of these, 2,326 are rated as scientists and scientific assistants. This shows an increase since July 1, 1897, of 3,003 persons on the rolls of the department, of which the increase in the number of the scientific staff in the same period was 1,401.

In conclusion, the secretary says it has been a grateful task to present to the president and thus to the American people a pen picture of the American farmer as he is to-day, to make clear the position of the farming industry, its wonderful productiveness, and its large contribution to the general prosperity of the country. He has also pointed out some of the more important work illustrative of the methods by which the department seeks to benefit the farmer. Its work is two-fold. It seeks to add to the sum of intelligence in the man and to increase the productive capacity of the acre. In this work the department has the hearty cooperation of the agricultural colleges and experiment stations, all working with the department to the same great end. The gratifying evidences of well-being in the farming community, the extraordinary progress made, and the enlarged recognition of the true position of the farming industry in the economic life of the country are mainly the result of this continued and combined effort on the part of these agencies to add to the sum of the farmer's knowledge, and must be regarded as the triumph of intelligence in the application of scientific knowledge to the tillage of the soil. This he maintains is so true that it would be superfluous to urge the generous maintenance of the department in its grand work.

Great as has been the work undertaken and accomplished, gratifying as have been the results as shown in the first few pages of this report, be it remembered that we are still at the threshold of agricultural development and that the educational work which has led to such grand results has only been extended as yet to a portion of our agricultural population.

SCIENTIFIC BOOKS.

NEWCOMB'S REMINISCENCES.[1]

When a man lays down the arduous pen of the mathematician, which he has used throughout a long life to the admiration of the world, and takes up in leisurely fashion that of the autobiographer, he is tolerably sure of our respectful attention. But Professor Newcomb has won from us far more than this: he has earned our lasting gratitude by the production of a book which is delightful to read and which makes several contributions to the history of astronomy. Of the eminently readable character of the book it is easy to assure oneself by opening it at random, for on almost every page there is an anecdote or the equivalent, rendered accessible to the lay reader, where necessary, by admirable exposition of astronomical terms and touched infallibly with a genial humor. The variety of topic is specially noteworthy; the author is as much at home in explaining why the United States results from the Transits of Venus were not reduced (because after spending $375,000 on the observations it was found to be impossible to secure $5,000 for the computations—see p. 178) as he is in vividly sketching Mr. Gladstone thus:

[1] 'The Reminiscences of an Astronomer,' by Simon Newcomb. Houghton, Mifflin & Co., 1903.

It could not be said that he had either the dry humor of Mr. Evarts or the wit of Mr. Depew; but these qualities were well replaced by the vivacity of his manner and the intellectuality of his face. He looked as if he had something interesting he wanted to tell you; and he proceeded to tell it in a very felicitous way as regarded both manner and language, but without anything that savored of eloquence (p. 276).

Or we may turn to another page and find a note, brief but vigorous, on the visit of Dom Pedro of Brazil 'the only emperor who had ever set foot on our shores.' (May we Englishmen hope that the Emperor of India will be the second?) On another page is a good story of Argelander and Gould.

When with him [Argelander] as a student, Gould was beardless, but had a good head of hair. Returning some years later, he had became bald, but had made up for it by having a full, long beard. He entered Argelander's study unannounced. At first the astronomer did not recognize him.

"Do you not know me, Herr Professor?" The astronomer looked more closely. "Mein Gott! It is Gould mit his hair struck through!"

[By the way, there is a little misprint in the German.]

But, as above remarked, there are many real pieces of astronomical history, related with the same charm of simple directness. We may surely rank as such the incidents connected with the discovery of 'Lane's Law,' for instance. Newcomb was walking home after a scientific club meeting with Mr. Taylor and—

A little man whose name he did not even know, as there was nothing but his oddity to excite any interest in him, and on the way was explaining a theory to his companions in that *ex cathedra* style which one is apt to assume in setting forth a new idea to people who know little or nothing of the subject. My talk was mainly designed for Mr. Taylor because I did not suppose the little man would take any interest in it. I was, therefore, much astonished when, at a certain point, he challenged, in quite a decisive tone, the correctness of one of my propositions, * * * informing us that he had investigated the whole subject and found so and so—different from what I had been laying down. * * * Naturally I cultivated the acquaintance of such a man. His name was J. Homer Lane (p. 247).

And again we may put in this category the generous record of the fact that the genius of the Clarks as makers of object-glasses was first recognized in England; the agent being the Rev. W. R. Dawes, who saw, from a letter sent him by Mr. Clark,

describing a number of objects which he had seen with telescopes of his own make, that the instruments must be of great excellence, and ordered one or more of them. "Not until then were the abilities of the American maker recognized in his own country" (p. 149).

Or again we may reckon as a historical incident the vindication, by Professor Newcomb himself, of Father Hell, who had half a century earlier been accused by Littrow of forging records of observations of the Transit of Venus. By protracted study of the original manuscripts, Newcomb was led to suspect that Littrow could not see differences in color between inks, and on inquiry learned that he was color-blind.

No further research was necessary. For half a century the astronomical world had based an impression on the innocent but mistaken evidence of a color-blind man respecting the tints of ink in a manuscript (p. 160).

It was not the only occasion on which Professor Newcomb inferred a fatal flaw in eyesight from faulty work. On taking charge of the Nautical Almanac Office he found that his proof-reader could not read proofs—he did not appear to see figures, or be able to distinguish whether they were right or wrong, and, therefore, was useless as a proof-reader. "It is not his fault," was the reply; "he nearly lost his eyesight in the civil war, and it is hard for him to see at all." In the view of counsel this ought to have settled the case in his favor (p. 215). We may put alongside this story Airy's condition of efficiency in another kind of assistant. "I never," he said, "allow an operator who can speak with the instruments to take part in determining a telegraphic longitude" (p. 290). For the explanation we must refer the reader to the book itself.

Airy is referred to by the author as 'the

most commanding figure in the astronomy of our time.' Perhaps the same phrase may be used, with alteration in date, of Newcomb himself. At any rate, his figure is conspicuous enough to justify many times over the autobiographical references in the early part of the book, for which he makes a modest apology in the preface. We are sure that the opinion of the friends who urged their publication will be endorsed by a wide circle of readers. To be able to identify the Newcomb we know—the man who courageously set out to reduce to order a vast mass of heterogeneous accumulated observations, and who did it—with the child who taught himself to add by using a bed-quilt as an abacus; with the boy who listened to an astronomical lecture by his father (somewhat as J. Homer Lane afterwards listened to Newcomb himself) and then said, 'Father, I think you were wrong in one thing' (the story is told by the father); with the youth who was apprenticed to a quack doctor and ran away because he could not stand the quackery; with the man who became perforce a soldier at a moment's notice —there is surely nothing of harm in our being allowed this possibility, and equally surely there is much of good. We are grateful to the author for putting aside his own natural feelings in the interests of his readers.

A critic is morally bound to devote one paragraph to complaints, and we will complain of some deficiency in references. There is, for instance, a chapter on 'Scientific England,' describing a visit to Europe with no date attached. After looking through the chapter in vain for a date, we turned to the index for the eclipse which is referred to several times in the chapter as supplying the motive for the expedition. It is not mentioned in the index! Another eclipse (that of 1860, observed in America by Newcomb) is indexed, but there is no reference to the one mentioned at least half a dozen times in Chapter X.

But having fulfilled this critical duty, we gladly return to the more congenial attitude of commendation, and say that the book is beautifully printed, and that there is an excellent portrait of the author as a frontispiece, which is in itself enough to make the book worth buying.

H. H. Turner.

University Observatory, Oxford,
November 11, 1905.

Naturkonstanten in alphabetischer Anordnung. By Professor Dr. H. Erdmann and Privatdocent Dr. P. Koethner. Berlin, Julius Springer. 1905. 8vo. Pp. 192.

This book on 'Constants of Nature' is mainly a collection of tables, containing such information as, in the opinion of the authors, is most frequently needed in chemical and physical calculations. The selection made seems in general to be a good one, though some additions might have made it more useful to the physicist. For example, there is no table of the density of mercury at different temperatures, no magnetic data, and under the discussion of temperature measurement no mention of thermocouples or pyrometers.

The subject matter is arranged alphabetically and the book is furnished with a handy thumb index. In the selection of headings two distinct principles have been employed. We find (1) the chemical elements—including their salts—with the most important data relating to them and (2) a discussion of physical and chemical methods of measurement with tables containing the numerical constants for various substances. For example, under 'Iron' the density, melting point and boiling point of the element, the lines of its arc and spark spectrum are given; then follow the molecular weight and density of twenty, the solubility at different temperatures of seven iron salts, the multiples and their logarithms of the atomic weight, the specific gravity of $FeSO_4$, $FeCl_3$ and $Fe_2(SO_4)_3$ solutions of different concentration and finally the logarithms of constants, frequently used in chemical analyses, for example

$$\log \frac{Fe_2}{FeO} \text{ or } \log \frac{FeSO_4 + 7aq}{FeO_3}.$$

This will show the great usefulness of the book, especially for chemical work. Such an arrangement proves in a great many cases more convenient and—if we can speak of such a thing in a collection of tables—more inter-

esting than the arrangement usually followed.

Interlarded with the elements are the separate headings for chemical, physical and mathematical constants, for instance: Analysis, solutions, acoustic, electric, optical and critical constants, logarithms and antilogarithms. The table of atomic weights is based on the values, published by the international committee for 1905.

In some of these cases it might have been better to combine such headings as 'Barometer,' 'Gases' (with reduction of barometric readings) and 'Air'—or 'Freezing Mixtures,' 'Temperature Measurement,' 'Thermochemistry' and 'Heat Constants,' instead of having each in a different part of the book. There are, however, a large number of cross references and an excellent index to facilitate its use.

In these chapters on constants the authors have added some text, containing definitions, derivations and explanations of the more important formulæ, and frequent valuable references to the literature. The chapter on 'Units' is the weakest part, since several mistakes and many loose statements have crept in which should not occur in a book of this kind. The gram is defined as the weight of one cubic centimeter of water at 4° C., instead of the concrete unit; density and specific gravity are used as synonyms. While the numerical values may be identical, namely, if we adopt as unit volume the milliliter, or the wrong definition of the gram (as mass) given by the authors, the two names have not the same physical meaning. The metric equivalent of the English yard is given incorrectly and as the two units of capacity in the United States we find the gallon and the cask, the latter to equal 121.1296 liters. The reviewer feels confident that with him many readers of SCIENCE are ignorant of the existence of such a unit, though certainly one of this size might exist in addition to the many others. The bushel, however, is not given. It would have been well to add to the metric horsepower, as used in Germany, the equivalent of the English horsepower. The electrical units have not been defined in accordance with international agreement or with the values legalized in Germany; that the E.M.F. of a Clark standard cell is given as 0.69735 volt—the reciprocal of its actual value—may be an oversight.

A distinction, though by no means clear, seems to be made between 'Masse,' 'Gewicht' and 'Schwere,' the second probably corresponding in meaning to Holman's 'Weightal,' *i. e.*, the quantity of substance as measured by weighing; but the use of the first two as synonyms and the statement that the gram-weight is one of the units of the c.g.s. system (see also: One Joule = 0.1019 mkg.) leads finally to an evaluation of the 'weight' of the sun instead of its mass.

While the reviewer may appear over-particular in such questions, it can not be sufficiently emphasized how harmful mistakes of this kind are. Like a fog in an otherwise beautiful landscape, they have led many a man off the right road. But this book is principally intended for those who have passed the danger point or are not concerned with definitions of this kind, and for such it will prove to be very useful on account of its handy size and the good selection of the material.

K. E. GUTHE.

STATE UNIVERSITY OF IOWA.

Die heterogenen Gleichgewichte vom Standpunkte der Phasenlehre. By H. W. BAKHUIS ROOZEBOOM. Zweites Heft: Systeme aus zwei Komponenten. Erster Teil. 14 x 22 cm.; pp. xii + 465. Braunschweig, Friedrich Vieweg und Sohn. 1904.

In this volume the author discusses equilibrium phenomena for two-component systems in which only the components can occur as solid phases. Compounds and solid solutions are to be considered in a later volume. Mixtures of gases apparently do not come under the scope of the book and the author starts off with the equilibrium between liquid and vapor. We have the boiling-point curves for mixtures which give neither a maximum nor a minimum boiling-point, for pairs of liquids with a constant maximum boiling-point, and for pairs of liquids with a constant minimum boiling-point. We also have the pressure-con-

centration curves for these systems at constant temperature. In addition to a discussion of the possible qualitative forms of the partial pressure curves, there is a consideration of the quantitative values with special reference to the formulas of Duhem, van der Waals and van't Hoff. The only thing lacking in this summary is a statement of the relation between the heat of dilution and the displacement of a maximum or minimum boiling-point with change of pressure.

Next in order is a discussion of the complete freezing-point curve. Of special interest is the chapter on the methods of determining the freezing-point curves and the nature of the solid phases. We can locate a freezing-point curve either thermally by cooling- or heating-curves, or analytically by solubility determinations at constant temperature. For aqueous solutions the latter method is usually the more accurate; but the thermal method is the better for alloys and fused salts, owing to the difficulty of pipetting off the pure solution.

Roozeboom groups the methods for determining the nature of a solid phase under the headings: 'Direct Analysis,' 'Microscopic Examination,' 'Conductivity,' 'Electromotive Force,' 'Heat of Formation,' 'Other Methods.' While these methods have all been used more or less extensively, they are of very unequal value. When possible, isolation of the solid phase and direct analysis is the most accurate of all. This, however, is usually not feasible in the case of alloys and is often unsatisfactory with efflorescing salts. Microscopic examination is the only method which is of real value for alloys. The methods grouped under conductivity and electromotive force are worthless as general methods and are not to be recommended in special cases except as giving corroborative evidence. Much the same may be said of density determinations, while no one has ever got any results by determining the heat of formation of alloys.

The last portion of the book is devoted to a consideration of equilibrium under high pressures, the phenomena near the critical points forming a special case under this general heading. While interesting in itself and important from a theoretical point of view, this section will probably appeal less to the average chemist than will other portions of the book, because relatively few of us have ever had the opportunity of working with high pressures.

Wilder D. Bancroft.

SCIENTIFIC JOURNALS AND ARTICLES.

The American Naturalist for November contains the following articles: 'Collection and Preparation of Material for Classes in Elementary Zoology,' by B. G. Smith, giving the methods in use at the University of Michigan; 'A New Ostracod from Nantucket, *Cyprinotus americanus*,' by Joseph A. Cushman; 'Further Notes on *Hyla andersonii* and *Rana virgatipes* in New Jersey,' by W. T. Davis; 'A Systematic Study of the Salicaceæ,' by D. P. Penhallow; the concluding paper containing a synopsis of the genera and species and list of literature on the subject. 'Momentum in Variation,' by F. B. Loomis, is an all too brief attempt to explain the development of parts beyond the point of apparent utility. Many of the statements need qualification, many are erroneous, and the subject is not one to be disposed of in five pages; it is safer to say we do not know.

The American Journal of Anatomy for December contains the following articles:

John Warren: 'The Development of the Paraphysis and the Pineal Region in *Necturus maculatus*.' 23 text-figures.

E. T. Bell: 'The Development of the Thymus.' 3 plates and 5 text-figures.

J. S. Ferguson: 'The Veins of the Adrenal.' 3 text-figures.

George Walker: 'The Blood Vessels of the Prostate Gland.' 2 colored plates.

B. M. Allen: 'The Embryonic Development of the Rete-Cords and Sex-Cords of *Chrysemys*.' 1 double plate and 6 text-figures.

F. T. Lewis: 'The Development of the Lymphatic System in Rabbits.' 8 text-figures.

F. T. Lewis: 'The Development of the Veins in the Limbs of Rabbit Embryos.' 1 text-figure.

A notice to members of the Association of American Anatomists of the approaching meeting, Christmas week.

The Annual Report of the Public Museum of Milwaukee, for the year ending August 31,

1905. The Milwaukee Museum is to be congratulated on the promptness with which its report has been issued and on the progress made during the year. The special stress laid upon educational exhibits, and its relations with and assistance to the public schools is of interest, as one of many reminders of the great changes that have taken place in museums. The Milwaukee Museum is fortunate in having a small lecture room for the use of schools, although the lectures given are by a special teacher of the public school system, and not by a member of the museum staff. In this connection it is somewhat amusing to note the claims made by different institutions regarding the value of their educational work, and it may be suggested that besides Pittsburg and Milwaukee, the American Museum of Natural History, with its loan collection studied, or at least seen, by 365,000 children and its lectures to thousands of pupils, should not be overlooked. There is also the New York Botanical Garden with its museum and lectures, and the Children's Museum of the Brooklyn Institute with its 100,000 visitors, 25,000 readers and lectures attended by all who can crowd in. However, Scripture says that we should not hide our (educational) lights under bushel baskets, and it is well for the public to know that much earnest effort is being expended to make museums interesting and of value to school children.

SOCIETIES AND ACADEMIES.

THE CONVOCATION WEEK MEETINGS OF SCIENTIFIC SOCIETIES.

There will meet at New Orleans:

The American Association for the Advancement of Science.—The week beginning on December 28. Retiring president, Professor W. G. Farlow, Harvard University; president-elect, Professor C. M. Woodward, Washington University, St. Louis, Mo.; permanent secretary, Dr. L. O. Howard, Cosmos Club, Washington, D. C.; general secretary, Professor C. A. Waldo, Purdue University, Lafayette, Ind.; secretary of the council, Dr. John F. Hayford, U. S. Coast and Geodetic Survey, Washington, D. C.

Local Executive Committee.—Honorary president, President E. B. Craighead, Tulane University; executive president, Professor George E. Beyer, Tulane University; secretary, Henry M. Mayo, The New Orleans Progressive League; treasurer, Mr. Clarence F. Low, of the Liverpool, London and Globe Insurance Company.

Section A, Mathematics and Astronomy.—Vice-president, Dr. W. S. Eichelberger, U. S. Naval Observatory, Washington, D. C.; secretary, Professor L. G. Weld, University of Iowa, Iowa City, Iowa.

Section B, Physics.—Vice-president, Professor Henry Crew, Northwestern University, Evanston, Ill.; secretary, Professor Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

Section C, Chemistry.—Vice-president, Professor Charles F. Mabery, Case School of Applied Science, Cleveland, Ohio; secretary, Professor Charles L. Parsons, New Hampshire College of Agriculture, Durham, N. H.

Section D, Mechanical Science and Engineering.—Vice-president, Professor F. W. McNair, Houghton, Mich.; secretary, Professor Wm. T. Magruder, Ohio State University, Columbus, Ohio.

Section E, Geology and Geography.—Vice-president, Professor Wm. North Rice, Wesleyan University, Middletown, Conn.; secretary, Dr. Edmund O. Hovey, American Museum of Natural History, New York, N. Y.

Section F, Zoology.—Vice-president, Professor Henry B. Ward, University of Nebraska, Lincoln, Nebr.; secretary, Professor C. Judson Herrick, Denison University, Granville, Ohio.

Section G, Botany.—Vice-president, Dr. Erwin F. Smith, U. S. Department of Agriculture, Washington, D. C.; secretary, Professor F. E. Lloyd, Teachers College, Columbia University, New York, N. Y.

Section H, Anthropology.—Vice-president, Dr. George Grant MacCurdy, Yale University, New Haven, Conn.; secretary, George H. Pepper, American Museum of Natural History.

Section I, Social and Economic Science.—Professor Irving Fisher, Yale University, New Haven, Conn.; secretary, Dr. J. F. Crowell, Bureau of Statistics, Washington, D. C.

Section K, Physiology and Experimental Medicine.—Vice-president, Professor Wm. T. Sedgwick, Massachusetts Institute of Technology, Boston, Mass.; secretary, Dr. Wm. J. Gies, College of Physicians and Surgeons, Columbia University, New York City.

At New Orleans in conjunction with the American Association for the Advancement of Science there will meet:

The American Chemical Society.—President,

F. P. Venable, University of North Carolina; secretary, Dr. William A. Noyes, the Bureau of Standards, Washington, D. C.

The Botanical Society of America.—January 4. President, Professor R. A. Harper, University of Wisconsin; secretary, Dr. D. T. MacDougal, N. Y. Botanical Garden, Bronx Park, New York City.

The Association of Economic Entomologists.—January 1, 2, 3. President, Professor H. Garman, Lexington, Ky.; secretary, Professor H. E. Summers, Ames, Iowa.

At Ann Arbor will meet:

The American Society of Naturalists.—President, Professor William James, Harvard University; secretary, Professor W. E. Castle, Harvard University. President (Central Branch), Professor H. H. Donaldson, University of Chicago; secretary, Professor W. J. Moenkhaus, Indiana University. The Eastern Branch will not meet this year.

The American Society of Zoologists (Eastern and Central Branches).—December 28, 29, 30. President (Eastern Branch), Professor W. E. Castle, Harvard University; secretary, Professor H. S. Pratt, Haverford College. President (Central Branch), Professor Frank R. Lillie, University of Chicago; secretary, Professor C. E. McClung, University of Kansas.

The Society of American Bacteriologists.—December 28, 29. President, Professor Edwin O. Jordan, University of Chicago; secretary Professor Frederic P. Gorham, Brown University, Providence, R. I.

The American Physiological Society.—December 27, 28. President, Professor W. H. Howell, the Johns Hopkins University; secretary, Professor Lafayette B. Mendel, New Haven.

The Association of American Anatomists.—December 27, 28, 29. President, Professor Charles S. Minot, Harvard Medical School; secretary, Professor G. Carl Huber, 333 East Ann St., Ann Arbor, Mich.

The Society for Plant Morphology and Physiology.—December 27, 28, 29. President, Professor E. C. Jeffrey, Harvard University; secretary, Professor W. F. Ganong, Smith College, Northampton, Mass.

At New York City will meet:

The Astronomical and Astrophysical Society of America.—December 28. President, Professor Simon Newcomb; secretary, Professor Geo. C. Comstock, Washburn Observatory, Madison, Wis.

The American Physical Society.—December 28, 29. President, Professor Carl Barus, Brown University; secretary, Professor Ernest Merritt, Cornell University, Ithaca, N. Y.

The American Mathematical Society.—December 28, 29. President, Professor W. F. Osgood, Harvard University; secretary, Professor F. N. Cole, Columbia University.

At Cambridge will meet:

The American Psychological Association.—December 27–29. President, Professor Mary Whiton Calkins, Wellesley College; secretary, Professor Wm. Harper Davis, Lehigh University.

The American Philosophical Association.—December 27–29. President, Professor John Dewey, Columbia University; secretary, Professor John Grier Hibben, Princeton University.

At Ithaca will meet:

The American Anthropological Association.—December 27–29. President, Professor F. W. Putnam, Harvard University; secretary, Dr. Geo. Grant MacCurdy, Yale University, New Haven, Conn.

At Ottawa will meet:

The Geological Society of America.—December 27, 28, 29. President, Professor Raphael Pumpelly; secretary, Professor Herman L. Fairchild, Rochester, N. Y.

THE AMERICAN PHYSICAL SOCIETY.

THE fall meeting of the Physical Society was held in Fayerweather Hall, Columbia University, New York City, on Saturday, October 28, 1905. President Barus presided.

The society adopted the following minute expressive of the great loss sustained by itself and by the world of science in the death of our vice-president, our colleague and our friend, Professor DeWitt Bristol Brace, on October 2, 1905.

It was under the shadow of this bereavement that the autumn meeting of the society was convened—a bereavement which is a personal one to nearly every member of the organization. A frequent contributor to the program, a vice-president of the society, a charter member, and the genial friend of every other member, Professor Brace will be long and keenly missed by every one of us. For not only have our proceedings been enriched by his contributions to knowledge, but those in attendance upon our meetings have always been inspired by his devotion to pure science,

by his clear grasp of the vital connection between fact and theory and by his experimental skill.

Born at Wilson, New York, on January 5, 1859, he took his bachelor's degree at Boston University in 1881, at the same time specializing in physics at the Massachusetts Institute of Technology. In his graduate work, he had the good fortune to come under the influence of Rowland and Helmholtz, with the latter of whom he took his doctor's degree. Two years of mathematical physics with Kirchhoff was also a potent factor in his development.

His researches, covering a wide range of optical subjects, are described mainly in *Wiedemann's Annalen,* the *Philosophical Magazine,* the *Astrophysical Journal* and the *Physical Review,* during the twenty years following 1885, when his doctor's dissertation appeared in the first-mentioned periodical.

Those who were associated with him as students at Baltimore and Berlin, those who have worked with him as colleagues in the University at Lincoln, those students who have come under his guidance in the laboratory and those who have accepted the generous hospitality of his home, unite in admiration of the fine qualities of mind and the high ideals which made him at once a successful teacher and an effective investigator.

His modesty was innate, his courtesy never failing, his energy and singleness of purpose a powerful stimulus to all who knew him.

The papers presented were as follows:

GEO. A. HULETT: 'Standard Cells with Electrolytic Mercurous Sulphate as Depolarizer.'

F. L. TUFTS: 'The Phenomena of Ionization in Flame Gases and Vapors.'

L. A. BAUER: 'Instruments and Methods used in the Magnetic Survey of the North Pacific Ocean by the Carnegie Institution of Washington.'

F. C. BLAKE and C. R. FOUNTAIN: 'The Transmission and Reflection of Electric Waves by Screens of Resonators and Grids.'

CARL BARUS: 'The Nucleation of Dust-free Air, Energized or not, Observed at Successively Increasing Supersaturation.'

C. C. TROWBRIDGE: 'The Duration of the After Glow Produced by the Electrodeless Discharge.'

E. L. NICHOLS and ERNEST MERRITT: 'The Decay of Phosphorescence in Sidot Blende.'

FANNY COOK GATES: 'The Conductivity of the Air due to the Sulphate of Quinine.'

C. D. CHILD: 'The Conductivity of the Vapor from a Mercury Arc.'

E. B. ROSA: 'The Construction and Measurement of Standards of Inductance.'

E. B. ROSA and N. E. DORSEY: 'Preliminary Report on a New Determination of v, the Ratio of the Electromagnetic and Electrostatic Units.'

The next meeting of the society—the annual meeting—will be held in New York City, December 29–30, 1905.

ERNEST MERRITT,
Secretary.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

AT the 170th meeting of the society, on November 8, the following papers were presented. Mr. C. D. Walcott discussed 'The Cambrian of Western Utah.'

The Morrison Formation and its Relations with the Comanche Series and the Dakota Formation: Mr. T. W. STANTON.

The Morrison formation is the dinosaur-bearing horizon, long known as the Atlantosaurus beds, lying between the Red Beds and the Dakota formation along the foothills of the Front Range in Colorado. Similar beds of approximately the same age occur widely distributed in the Black Hills region, Wyoming, Montana and western Colorado. The deposits are all non-marine and they have usually been referred to the Jurassic on account of the character of the reptilian fauna, though some authorities have recently assigned them to the Lower Cretaceous.

In Texas there is a great development of marine Lower Cretaceous rocks known as the Comanche series. The upper, or Washita, group of this series extends beyond the lower groups toward the north and west, so that in southern Kansas and eastern New Mexico it rests on the Red Beds, and, as it is limited above by the Dakota formation, it there seems to hold the same position as the Morrison formation in the general geologic column.

The work of Messrs. W. T. Lee and N. H. Darton during the past three or four years

has extended the known limits of the Comanche series with its marine fossils to the northwest corner of Oklahoma and into northeastern Colorado, and it has also proved the extension of the Morrison formation into the same area. These geologists believed that they had traced the Morrison formation laterally into the marine beds of the Comanche series and that they had thus proved it to be of the same age.

During the past summer the area in question was examined by Messrs. Lee, Stanton and Gilmore and it was found that the beds containing the Comanche fauna overlie the Morrison formation wherever both horizons occur in the same section. This relation was seen on Purgatoire River south of La Junta, Colorado; on the Cimarron from Garrett, Oklahoma, to the neighborhood of Folsom, New Mexico; on the Canadian north of Tucumcari, New Mexico; and finally in Garden Park, near Canyon City, Colorado, at the noted locality for Morrison vertebrates. At all these localities the Comanche horizon has previously been included among the beds referred to the Dakota, and the error in correlation when the Comanche fossils were supposed to have come from beds of Morrison age was due to the failure to locate the fossils accurately in the local sections. The Morrison formation underlies all the Comanche beds that extend into the same area, and is, therefore, distinctly older than those with which it was supposed to be contemporaneous. The question whether it is Upper Jurassic or Lower Cretaceous is still left open. The Dakota formation is much more intimately connected with the Comanche series than is the Morrison.

The Subdivisions of the Shenandoah Limestone: Mr. R. S. Bassler.

The name Shenandoah limestone proposed by Darton for the Valley limestone of early geologists was made to include all the limestones in the Valley of Virginia occupying the interval between the Cambrian quartzites and the Upper Ordovician shales. The lower portion of the great limestone series had been found by Mr. Walcott to include Lower, Middle and Upper Cambrian rocks, but the Ordovician portion had been determined only to the extent that Trenton strata were supposed to occur at the top. The work of the writer in Virginia brought out the fact that the geologic succession of the Ordovician division was quite different in various parts of the Valley. In northwestern Virginia a great thickness of Beekmantown is overlaid by 1,000 feet of Stones River, and this in turn by 400 feet of Black River, while the strata-bearing Trenton fossils form the lowest division of the overlying shales. In central western Virginia the Black River alone rests upon the Beekmantown, but in southwestern Virginia two distinct arrangements were noted. Along the western edge of the Valley the Beekmantown is followed by 1,000 or more feet of Stones River but no Black River, while along the eastern side only the Black River occupies the interval between the overlying shales and the Beekmantown. In each case the Trenton does not form the upper part of the limestone, but is the basal member of the overlying shales.

The Shenandoah limestone, therefore, is a broad term, embracing strata of Cambrian and Ordovician age, the geologic succession of the latter varying in different parts of even the type area.

M. L. Fuller,
Secretary pro tem.

The National Geographic Society.

The National Geographic Society, whose headquarters are in Washington, will conclude the eighteenth year of its history on December 31 of this year. The society has a membership of considerably over 10,000, which makes it the largest geographical association in the world. About 1,400 of its members reside in Washington, while the others are well distributed throughout the United States and in foreign countries. The annual dinner of the society will be held at the New Willard in Washington, D. C., on December 20. The Secretary of War, Hon. William H. Taft, and Mrs. Taft will be the guests of honor of the society. The following program of meetings for 1905 and 1906 has been arranged for Washington. The majority of the addresses are published in the magazine of the society.

PROGRAM OF MEETINGS.

The Popular Course.

November 10.—'A Review of the Russo-Japanese War—from the Sinking of the *Variag* to the Signing of the Treaty of Portsmouth,' by Mr. Robert L. Dunn, special correspondent of *Collier's Weekly* in the far east.

November 24.—'The Panama Canal,' by Hon. James R. Mann, member of congress from Illinois.

November 25.—'My Captivity in Morocco,' by Mr. Ion Perdicaris.

December 8.—'What Shall be Done with the Yosemite Valley?' by Mr. William E. Curtis, illustrated. The Yosemite Valley has been receded to the federal government by act of the California legislature, but has not yet been formally accepted by congress.

December 21.—'A Military Observer in Manchuria,' by Major Joseph Kuhn, U.S.A., illustrated.

December 22.—'An Attempt at an Interpretation of Japanese Character,' by Hon. Eki Hioki, first secretary of the Japanese legation.

January 5.—'Russia and the Russian People,' by Mr. Melville E. Stone, general manager of the Associated Press. It will be remembered that it was Mr. Stone who two years ago persuaded the Czar Nichols to grant freedom from the censor to foreign correspondence from St. Petersburg.

January 9.—'The Ziegler Polar Expedition of 1903–1905,' by Messrs. W. S. Champ, Anthony Fiala and W. J. Peters.

January 19.—'Railway Rates,' by Hon. Martin A. Knapp, president of the Interstate Commerce Commission.

January 31.—'China,' by Hon. Charles Denby, of the state department, and for many years resident in China.

February 2.—'Austria Hungary,' by Edwin A. Grosvenor, LL.D., professor of international law in Amherst College, author of 'Constantinople,' 'Contemporary History,' etc.

February 10.—'A Flamingo City, Bird Life in the Bahamas,' by Dr. Frank M. Chapman, of the American Museum of Natural History.

February 16.—'Africa from Sea to Center,' by Mr. Herbert L. Bridgman, illustrated. Africa in transition to-day challenges the attention of the world. Few intelligent Americans know to what extent its possibilities have been developed since Livingstone's day, a development that in rapidity promises to exceed that of North America.

February 23.—'The Personal Washington,' by Mr. W. W. Ellsworth, of the Century Company, illustrated. This is not a lecture in the ordinary sense of the word, but it is an exhibition, through the medium of the stereopticon, of the greatest collection of prints, manuscripts and letters referring to the personal side of Washington ever brought together.

March 2.—'Our Immigrants: Where They Come from, What They Are and What They Do After They Get Here,' by Hon. F. P. Sargent, U. S. commissioner general of immigration, illustrated.

March 16.—'Oriental Markets and Market Places,' by Hon. O. P. Austin, chief U. S. Bureau of Statistics, illustrated.

March 30.—It is hoped that official business will permit the secretary of the navy, Honorable Charles J. Bonaparte, to address the society on 'The American Navy.'

April 13.—'The Regeneration of Korea by Japan,' by Mr. George Kennan, illustrated.

Scientific Meetings.

November 17.—'Morocco,' by Mr. Ion Perdicaris.

November 22.—'Sixteen Years in China,' by Rev. Charles A. Killie, F.R.G.S., official photographer of the siege of Peking, illustrated.

November 29.—'The Panama Canal,' by Mr. Bunau-Varilla.

December 1.—'The Development of the Mineral Resources of Alaska, with particular reference to the Fairbanks and Nome Regions,' by Mr. Alfred H. Brooks, chief of the Alaskan Division U. S. Geological Survey.

December 15.—'Surveying our Coasts and Harbors,' by Hon. O. H. Tittmann, superintendent U. S. Coast and Geodetic Survey.

December 29.—'Problems for Geographical Research,' by Gen. A. W. Greely, U.S.A. 'The Binding Power of Road Material,' by Mr. A. S. Cushman.

January 12.—Annual meeting. Reports and elections. 'Progress in the Reclamation of the West,' by Mr. F. H. Newell, chief engineer reclamation service.

January 26.—'The Carnegie Institution,' by President R. S. Woodward.

February 9.—'The Introduction of Foreign Plants,' by Mr. David G. Fairchild, agricultural explorer, U. S. Department of Agriculture.

February 24.—'Hunting with the Camera,' by Hon. George Shiras, member of congress from third district, Pennsylvania.

March 9.—'The United States Bureau of the Census,' by Hon. S. N. D. North, director.

March 23.—'The Death Valley,' by Mr. Robert H. Chapman, U. S. Geological Survey.

April 6.—'The Total Eclipse of the Sun, July, 1905, as Observed in Spain,' by Rear Admiral

Colby M. Chester, U.S.N., superintendent U. S. Naval Observatory.

April 20.—'The Protection of the United States against Invasion by Disease,' by Dr. Walter Wyman, surgeon-general Marine Hospital Service.

The Magazine.

The magazine of the society contains many large colored maps. Four such maps were published in the 1905 volume: (1) A chart of the world, 25 x 45 inches, and in four colors, showing all submarine cable systems and connections and the steamship routes of the world; (2) a map of northern Manchuria, in two colors, 18 x 44 inches; (3) a map of the Philippines, in four colors, 23 x 36 inches; (4) a map of the Panama Canal region, in five colors, 24 x 33 inches. The magazine is very handsomely illustrated. All members of the society receive the magazine free of charge.

THE TORREY BOTANICAL CLUB.

The meeting of October 10 was held at the American Museum of Natural History, with President Rusby in the chair and twenty-two persons present.

A letter was read from Mr. Edward W. Berry, tendering his resignation as recording secretary of the club, owing to his removal to Baltimore.

The announced program for the evening consisted of informal reports on the summer's work and observations. Several from whom reports were expected were unable to be present.

Professor Francis E. Lloyd gave an account of his summer's experiences at the Desert Botanical Laboratory of the Carnegie Institution at Tucson, Arizona. On the way thither a visit was made to the Tularosa Desert in southern New Mexico. This desert is largely an old lake bed of a comparatively recent geological period. The moving white sands which compose the desert overlie the mesa and consist chiefly of gypsum, and a little below the surface there is a considerable amount of available water, which, however, is saline. The vegetation of the region is peculiar, showing various adaptations to the intense light. Several interesting cases were observed showing how yuccas and other plants are able by continued vertical growth to keep their tops above the drifts of sand and how in the process they help to build up and hold the dunes. *Rhus trilobata* and also a shrubby labiate form very marked pillar dunes. The gypsum sand is partly soluble and it solidifies about the vertically elongating roots and stems; the outer parts of the dune may then erode and be removed by the wind, leaving an isolated pillar-like mass surmounted by the tops of the living shrubs. An interesting and not especially common plant of the region of Tucson is *Cereus Greggii,* of a habit so peculiar and aberrant that it does not seem to be a *Cereus* at all. Like certain other desert plants it has an underground storage system which is very large in comparison with the above-ground parts. The rapidity with which foliage appears on desert plants after rains has been often noted, and it has been a question in how far growth of leaves may be stimulated by the direct access of water to the above-ground parts without the intervention of the root-system. This point was tested during the past summer by experiments at the Desert Botanical Laboratory. By means of a siphon, water was supplied directly to the leaf-buds and stems, in such a way as to prevent the water from reaching the ground. It was found that the desert plants thus stimulated produce leaves in the course of a few days. Very noticeable changes occur within twenty-four hours, both when plants are stimulated as described and after natural irrigation by rains. Professor Lloyd further observed diurnal nutations and nyctitropic movements in an amaranth growing near the Desert Laboratory. Photographs were shown illustrating the observations commented upon.

Dr. William A. Murrill spoke briefly of his collections of fungi during the summer at Ohio Pyle, Pa., in the District of Columbia and in the Mt. Katahdin region of Maine, describing also some of his camping experiences in the Maine woods. Dr. Murrill was impressed by the boreal character of the fleshy fungi found about Mt. Katahdin, many of them recalling species that he had collected in Sweden.

President Rusby reported on a Torrey Club

excursion to Pompton Plains, New Jersey, where *Capnoides flavulum* was among the rare plants obtained; also on a club excursion to Great Island, New Jersey. Great Island is a hummock of sand surrounded by a salt marsh and lying between Newark and Elizabeth; it has numerous interesting plants, some of them being characteristic of the pine-barren flora of the region further south.

Professor E. S. Burgess remarked upon his summer's visit to the Pacific Coast. Collections and field studies of asters were made in New Mexico, Arizona, California and Oregon. Mt. Hood, Ore., proved an especially interesting field. Asters were found growing there in close proximity to snow and ice.

Mrs. Britton alluded briefly to collecting experiences in Bermuda during September. Most of the species of ferns, mosses and hepatics are found there only in the 'caves' or sink-holes. Her collections indicate considerable additions to the list of mosses published in the Report of the *Challenger* Expedition.

Dr. J. H. Barnhart spoke of the International Botanical Congress held at Vienna in June, which he attended as a delegate from the New York Botanical Garden.

MARSHALL A. HOWE,
Secretary pro tem.

THE NEW YORK SECTION OF THE AMERICAN CHEMICAL SOCIETY.

THE second regular meeting of the New York Section, American Chemical Society, was held at the Chemists' Club, 108 West 55th Street, Friday, November 10, at 8:30 P.M., with an attendance of 78. The chairman, Dr. F. D. Dodge, presided.

Chrome Tanning: OTTO P. AMEND.

The first really important advance in practical chrome tanning was undoubtedly made by August Schulz in 1884. Schulz treated his skins in a bath containing bichromate of potash plus an acid until they were saturated, and after this they were placed in a second bath containing sulphurous acid or hyposulphite of soda plus an acid. This process has since been called the two bath process.

The one bath process consists in treating the skins with a basic solution of a chromic salt. Such a salt can be produced by adding washing soda to a chromium salt until sufficiently basic and then heating.

Differences in basicity have an important bearing on the tanning properties of chrome solutions. Chrome alum, on account of its acid character, penetrates the skin quickly, but fails to tan the skin thoroughly, is easily washed out, and produces leather of a greenish color. When more basic solutions are used, the penetration is slower, the tannage more complete, the chrome less easily washed out and the leather produced is of a more bluish shade. When the solution becomes very basic, the chromium salt will precipitate on dilution, but remains stable and perfectly dissolved in a concentrated solution.

Analysis of a number of chrome liquors on the market show that nearly all of them are produced by the reduction of bichromate of potash or soda, by means of glycerin, alcohol or glucose; most of them being sulphates.

5-Brom-2 Amino-benzoic-Acid and some of its Derivatives: MARSTON TAYLOR BOGERT and WILLIAM FLOWERS HAND.

5-Brom-2-acetaminobenzoic acid was prepared by direct bromination of acetanthranilic acid, and also by the oxidation of 5-brom-o-acettoluid. On saponification, it gave the 5-brom-2-aminobenzoic acid, while boiling acetic anhydride changed it to 5-brom-2-acetanthranil. 5-brom-2-acetaminobenzonitrile was obtained by the direct bromination of acteanthranilic nitrile. The above compounds were described, together with certain of their derivatives.

Fischer's Classification of Stereo-Isomers: M. A. ROSANOFF.

The author demonstrates that Emil Fischer's subdivision of the sugars and their derivatives into two enantio-morphous families is erroneous in a number of cases and therefore self-contradictory. He proposes a corrected classification which brings out the family relationships, of those compounds with great clearness, settles definitely the controversies that have arisen on the subject, and eliminates much

current misapprehension. For example, ordinary tartaric acid, generally considered as a relative of ordinary glucose, is presented by the new classification as a relative of the antipodal, levo-rotatory glucose. As a matter of fact, ordinary glucose changes, gradually, to arabinose, erythrose, threose, and, not ordinary, dextro-rotatory, but the levo-rotatory tartaric acid.

Chemical Examination of Æthusa Cynapium: Frederick B. Power and Frank Tutin.

The *Æthusa Cynapium* Linn., or 'fool's parsley,' known also as the 'lesser hemlock,' is a well-known annual garden weed, which is indigenous to Europe and northern Asia, and is the only representative of the genus. Numerous cases of poisoning have been attributed to this plant, in most of which it appears to have been mistaken for common garden parsley.

The author was led to take up his investigation because of the conflict of opinion as to the poisonous properties of the plant. He reports finding a small amount of an essential oil of a rather unpleasant odor, corresponding to 0.015 per cent. of the weight of the entire fresh plant. An amount of resinous substances corresponding to 0.8 per cent. A small amount of *d*-mannitol from which a hexaacetyl derivative was prepared. A considerable amount of inactive glucose and amorphous coloring matter, and an exceedingly small amount of volatile alkaloid, having the peculiar characteristic odor of coniine, and which like the latter yielded butyric acid on oxidation.

F. H. Pough,
Secretary.

THE UNIVERSITY OF COLORADO SCIENTIFIC SOCIETY.

During September and October, 1905, the society held six meetings with programs as follows:

Professor William Duane: 'Recent Discoveries in Radioactivity.'

Professor R. D. George: 'The Cœur d'Alene Mining District.'

Dr. Luman M. Giffin: 'A Quarter-Century Evolution of Medical Education.'

Professor John A. Hunter: 'Tungsten Steel.'

Professor T. D. A. Cockerell: 'Characters of Rocky Mountain Flora.'

Dr. J. E. Waxham: 'Medical Ethics.'

Dean F. B. R. Hellems: 'A Bronze Tablet and its Relation to Roman Constitutional History.'

The average attendance at the meetings was forty. Membership is not restricted to those connected with the university but is open to citizens of Boulder. A number of business and professional men have joined the society.

Francis Ramaley,
Secretary.

Boulder, Colo.,
November 5, 1905.

THE CLEMSON COLLEGE SCIENCE CLUB.

The 58th regular meeting of the Clemson College Science Club was held on Friday evening, October 25. Dr. Metcalf, Professor Chambliss and Professor Howard gave informal talks on their summer's work. Dr. Metcalf and Professor Chambliss spent several months in the rice fields of South Carolina, the former studying diseases of rice and the latter the insects injurious to the plant. A full report of rice diseases will shortly appear in a government publication. Professor Chambliss found the number of insects injurious to the rice plant to be twenty-one instead of eight, as formerly reported. One of the species found is undoubtedly new.

The principal paper of the evening was by Professor J. N. Harper, on 'The Breeding of Wheat.' It was based on experiments which he has carried on for the past three years and the conclusion reached was that the amount of protein in the wheat grain can be increased by physical selection and that the increased amount can be recognized by physical tests.

Fred H. H. Calhoun,
Secretary.

THE ELISHA MITCHELL SCIENTIFIC SOCIETY.

The 162d meeting of the society was held on November 14, when the following program was presented:

Mr. J. E. Latta: 'A Note on Electrocution.'

Mr. N. C. Curtis: 'Pillet's Method of Finding the Shortest Distance between two Lines.'

Mr. R. O. E. Davis: 'The Theory of Electrons.'

A. S. Wheeler,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

THE ARRANGEMENT OF MEETING ROOMS.

As the season of winter meetings approaches it may be permissible to make a few suggestions regarding the transformation of college lecture rooms into meeting rooms for scientific societies.

The ordinary college lecture room is arranged, properly enough, in a two-party fashion. The lecturer is on one side of the desk and the students are on the other. But a society meeting room should be arranged in a three-party or triangular fashion, so that the president and the secretary can see and can be seen by the two other parties, namely, the speaker and the members. If this principle is neglected, as is too often the case, and the president and the secretary are placed at the same desk with the speaker, various awkward results are likely to follow. The speaker is very apt to turn his back on the officers and to talk only to the members—if indeed he does not also turn his back on the members and talk only to the blackboard. The president, sitting with his back to the diagrams that are referred to by the speaker, is tempted to perform various twists in trying to see what is behind him. The members, finding two persons in line with the diagrams, do not always see clearly what it is intended that they should see.

These various difficulties disappear if the three-party arrangement is adopted. The speaker is then given sole possession of the lecture platform and desk, with the blackboard and racks behind them. The president and the secretary are given a table (with a platform also, if necessary) on the floor at one end and somewhat in front of the lecture desk, far enough forward for them to see the speaker and the blackboard when they look a little to one side, and high enough for them to see the members when they look to the other side. The members, from the ordinary seats, can then see both the speaker and the officers; the officers can see both the speaker and the members; and the speaker can observe the proprieties all through his remarks by looking at the officers and the members in turn. The only chance of awkwardness comes if the speaker takes his place at the end of the desk near the officers' table, for he may then turn his back on them, while pointing to his diagrams. To prevent this involuntary discourtesy the space behind the desk at the end near the officers' table should be blocked up, so that it can not be entered or occupied. The speaker will then necessarily enter from the other end and stand with his face turned toward the other two parties in the triangle; unless, as said before, he insists on facing only the blackboard. Inasmuch as speakers ordinarily use their right hand for chalk work it seems most generally satisfactory to place the officers near the left end of the lecture desk, as seen from the audience, and to keep the speaker near the right end.

Several other items may be briefly indicated. Some form of racks for diagrams should be provided beforehand, with simple means of attaching the diagrams and of raising the racks; spring clothes pins are of quieter action than tacks that have to be hammered: if the racks are hoisted by a cord over pulleys, the pulleys should have all squeaks reduced by oiling. The duty of darkening the room when the lantern is used should be assigned beforehand to a responsible and well-practised person of regular habits. Attention should be given to the windows, especially to the upper sashes, to see if they can be opened easily for ventilation, without over-much squeaking or slamming, and without conspicuous gymnastics on the part of the secretary; examples might be cited in which the antics performed in favor of ventilation have completely distracted the attention of the members from the matter presented by the speaker, which after all is usually the more important of the two forms of entertainment. If there are windows near the lecture desk, they should be darkened, so that the speaker and the officers shall not be recalled chiefly as blackened characters silhouetted against the light of outdoors in the eyes of the audience. If the entrance is at the back of the room an usher will be of value in urging members into the forward seats 'at the request of the presi-

dent'; for an audience on the back benches, leaving the front benches empty, can not be regarded as encouraging to the speaker. A young page at the service of the president and secretary is an appropriate luxury; he can be waked when messages have to be sent. A lobby into which members can retire for conversation is indispensable for a comfortable meeting; it should not be so near the meeting room that laughing in one drowns speaking in the other. As to the manner of presentation of scientific communications by the speakers, that is too sacred a question for us to enter upon. Individuality must be preserved at all hazards. But if a distinction *could* be drawn between the form in which a problem is prepared for publication and the form in which it is presented orally to a listening audience, and if the effect to be produced upon the audience *could* be duly considered by the speaker, scientific meetings would be even more successful than they are now.

One other practical suggestion may be allowed. It would be an assistance if the local committees would write down the more important results of their experience in a *transmittendum*, to be passed on to their successors. Thus, even if new mistakes were occasionally invented, old mistakes might be more generally avoided, and a greater enjoyment and profit might be secured for all concerned by the gradual removal of various trifling inconveniences and distractions which have no place in well-conducted meetings.

A Fellow of the Association.

SPECIAL ARTICLES.

NOTE ON THE FALLING-TO-PIECES OF THE IONS.

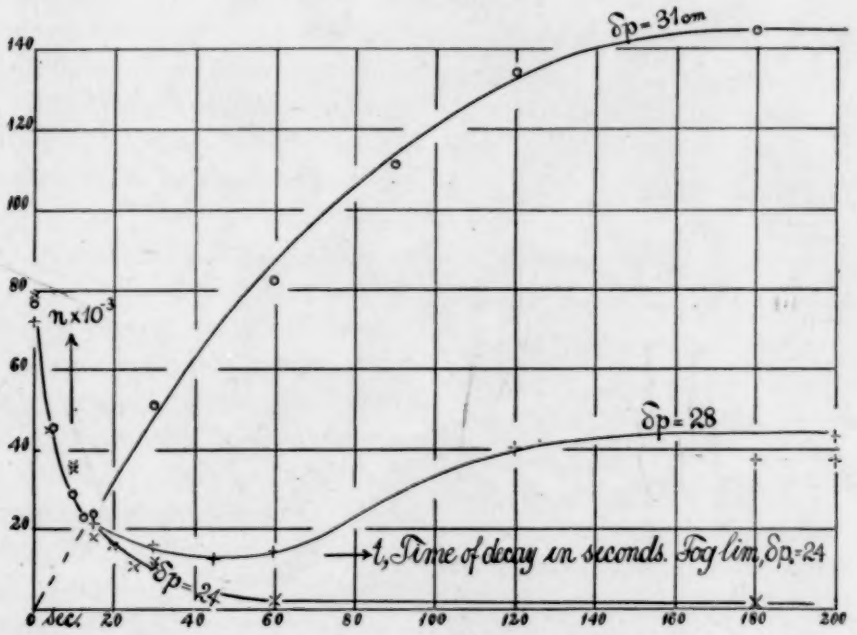
1. The data summarized in the following graphs were obtained by acting in the manner stated, on the dust-free moist air contained within a glass fog chamber, with a sample of weak radium (10,000 ×, 10 mg.), sealed in an aluminum tube. This was placed on the outside of the chamber in contact with its walls (.2 to .3 cm. thick), and was then removed suddenly at given intervals before exhaustion. Only very penetrating primary rays (β and γ) are, therefore, in question. The curves show the number of efficient nuclei in thousands per cubic centimeter, observed after the lapses of time shown by the abscissas, and it is supposed that the nuclei are reproduced faster than they can be removed by the exhaustion. In the upper curve the pressure differences applied ($\delta p = 31$) are much above the fog limit of dust-free air, which is below $\delta p_0 = 24$ for the given apparatus. In the lower curve the pressure differences are nearly at the fog limit of dust-free air, while the other curve ($\delta p = 28$) applies for intermediate conditions. The effect of the radiation is, therefore, virtually at least, a coagulation (to use a figurative expression) of the colloidal nuclei of dust-free air, into the aggregates much larger in size representing the ions. Hence in the presence of radium under the given conditions, the number of *efficient nuclei* decreases either because the ions from their size capture all the available moisture more and more fully, or because the colloidal nuclei have actually been aggregated into fewer but larger systems, which will in turn fall apart in the absence of radium. Professor Barus[1] has recently pointed out that inasmuch as the radiation within the fog chamber is largely secondary, and must, therefore, at a given point come from all directions, a corpuscular pressure must exist within, having a tendency to produce agglomeration; and the same results should occur for an easily scattered undulatory radiation. This would explain why the X-rays and ultra-violet light produce fleeting and persistent nuclei alike in kind, except that only the former are ionized.

2. It follows from what has been stated that above the fog limit of dust-free air, the number of efficient nuclei must increase with the removal of radium at a rate which corresponds to the falling to pieces of the ions. The peculiar feature of the results here in question is the manner in which the efficient nucleation decays from the coarser ionized to the finer non-ionized colloidal stages, when the pressure difference is decidedly above the fog limit of air, so that the latter may be recognized. The curves invariably pass through a minimum

[1] *Am. Jour. Sci.*, (4), XX., p. 298, 1905.

when the time after the removal of the radium, *i. e.*, the interval of decay, increases indefinitely.

This minimum, moreover, is very sharp, almost cusp-like, as if one law were passing abruptly into another. Thus below the minimum ($t = 13$ sec. about) the curve for $\delta p = 31$ nearly coincides with the curve for $\delta p = 24$, which is practically independent of the colloidal nuclei of air. The decay may be computed to be of the order of that of ions. After a lapse of 13 seconds the effect of colloidal nuclei is marked for $\delta p = 31$; and even after a lapse of 60 seconds, when the ions



(lower curve) have vanished to a few hundred, the upper curve is only half way on its march toward the asymptote. This shows the remarkable sensitiveness of the method as a test for the presence of ions or of any nuclei larger than the colloidal sizes. Moreover, measurement of the large coronas is relatively easy. Finally, the curve, $\delta p = 31$, if prolonged backwards, would seem to start nearly from the origin; in such a case one would have to picture to oneself a single coagulated particle breaking to pieces in the absence of radiation, into fragments of continually decreasing size, until the débris ultimately numbers 150,000 colloidal nuclei.

The intermediate curve ($\delta p = 28$) also coalesces[2] approximately with the other for lapses of time less than $t = 13$ sec. It has its own minimum, however, and from the lower pressure difference, necessarily its own asymptote at $n = 40{,}000$, since only the coarser order of air nuclei fall within the given limits of condensation in the apparatus used. For the same reason the minimum is lower and later, seeing that the ions are present throughout in relatively greater numbers, as compared with the efficient colloidal nuclei, than was the case at $\delta p = 31$.

3. The curves as a whole have so close a resemblance to the data investigated by Professor Barus for the effect of radium at different *distances* from the fog chamber that the same cause must underlie both series of observations. In the former case (distance effects) any given intensity of ionization between the maximum and the vanishing values may be maintained indefinitely by properly placing the radium tube; in the latter case (decay) all stages are passed through in two or three minutes. Beginning with dust-free non-energized air, the number of efficient nuclei decreases as the number of ions in-

[2] Considered relatively to the wide divergence after $t = 13$ sec. is passed. The coalescence need not be perfect. Small coronas fall out too rapidly for close measurement.

creases (for either or possibly both of the reasons already given) until the condensation takes place wholly on ions. For greater intensities of ionization the number of ions must increase further and hence the efficient nucleation rises again while the curve passes through a minimum.

The curves enable us to make certain interesting comparisons, inasmuch as the same nucleation results from radium decaying for a stated length of time, as results from the action of radium at a certain distance from the line of sight. From the importance of secondary radiation in connection with these observations, such comparisons are probably not simple. The essential feature is the passage of the nucleation through the same stages of variation, whether of size or of number, in both cases, no matter how the given successive intensities of ionization may be produced, or whether they come from within or without.

My thanks are due to Professor Barus for his suggestions and his assistance throughout the research.

Lulu B. Joslin.

Brown University,
Providence, R. I.

A LACUSTRINE APHID.

One would suppose that submerged aquatic plants might wholly escape the attacks of plant-lice and scale-insects. In the *Feuille des Jeunes Naturalistes,* February, 1905, p. 62, G. Goury describes a supposed scale-insect which he found on a submerged petiole of *Limnanthemum* near Fontainbleau, in France. Unhappily, he put it in an aquarium, and the pond-snails (*Limnæa*) devoured it during the night. This prevented him from giving a description, and although he names it *Lecanium limnanthemi,* we can not resist the observation that all he says about it would apply to a leech egg. However, it is possible for aquatic plants to be attacked by aphids, though these do not inhabit the wholly submerged parts. On October 7 of the present year, my wife and I visited a lake in the immediate vicinity of Boulder, Colorado. The shallow water contained a large quantity of *Myriophyllum verticillatum* L., a submerged plant with only small portions projecting above the surface. We were astonished to find that whenever the plant was not wholly submerged it was infested by aphids, usually in enormous numbers. At first I wondered whether they could have come from the adjacent terrestrial vegetation; but an examination of the narrow-leafed cottonwoods (*Populus*) and cockleburs (*Xanthium*) near by did not reveal any aphids. Closer inspection showed that the insects were thoroughly at home on the *Myriophyllum* and were undergoing all their transformations thereon. We brought some home, fully believing that we had something new, but on looking up the literature it was found impossible to distinguish them from the European (and doubtless circumpolar) *Rhopalosiphum nymphææ* (L.), which is said by Buckton to infest water-lilies (to which it is at times very destructive), *Alisma, Butomus, Potamogeton, Hydrocharis, Lemna,* etc.

The following description, from the Colorado material, is given because the available descriptions are somewhat incomplete; it will also be useful in case any doubt should arise as to the absolute identity of the European and American forms.

Winged Form.—Yellowish-olive, with the head, the chitinous plates of the thorax and the antennæ black; the middle of the abdomen also suffused with black; legs black, pallid only at extreme base; wings clear, stigma very light-yellowish, nervures black; nectaries incrassate, with the apical part black, the basal pallid; lateral edges of abdominal segments with alternate light and dark spots, best seen in balsam mount; antennæ on frontal tubercles; third joint with several sensoria on outer side, fifth with a sensorium in a notch not far from apex; surface of joints finely imbricated. Measurements: length of body about 1½ mm., of wing about 2½ mm.; the rest in μ—nectaries, 255; cauda narrow and fairly long, its width 37; anterior tarsus (excluding claws), 120; antennal joints, (3) 225, (4) 165, (5) 150, (6*a*) 97, (6*b*) 225. Wings with branched vein having distance from first branch to second, 620; second to tip of wing, 225.

Apterous Form.—About 2 mm. long, broad,

beak reaching lower edge of middle coxæ. Yellowish-brown or yellowish-olive; an obscure dark suffusion down the middle of the abdomen; antennæ, legs and apical part of nectaries, blackish. A whitish waxy powder on under surface. The young are pale green or pale reddish. The pupæ have more of the bluish-white wax, and have a very distinct dark mark on the middle of the abdomen.

The insects swim well on the surface of the water.

T. D. A. COCKERELL.

THE NEW ORLEANS MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE permanent secretary announces that owing to delayed negotiations with the railroads with regard to rates and on account of a printers' strike in Washington, the publication of the preliminary announcement of the New Orleans meeting has unfortunately been delayed. It is probable, however, that the announcement will be mailed to all members of the association from Washington about December 8. Additional information to that contained in the announcement will be found in SCIENCE of December 15 and December 22.

As announced last week the Southeastern Passenger Association, including practically the territory south of the Potomac and Ohio Rivers and east of the Mississippi, has granted a one-fare round trip rate plus 25 cents, and the Central Passenger Association has now adopted the same rate. Other passenger associations will either adopt this rate or with the northern associations a one-fare and one third rate to their southern terminals, the one-fare rate holding for distances south of these terminals. The latter plan has been adopted by the Trunk Line Association, which includes New York, New Jersey, nearly all of Pennsylvania, Delaware, Maryland and West Virginia north of Charleston. This will make a very reasonable rate amounting to about $36 from New York City and $27.75 from Washington.

The plans for the meeting are practically completed and many interesting features will be announced in addition to those already mentioned in these columns. The social features will include a smoker at the Washington Artillery Hall on Friday night, December 29; a general reception on the night of December 30, an excursion on December 31 to the large sugar plantations, receptions by private citizens of New Orleans, and personally conducted trolley rides over the city, particularly through the most interesting old and historic parts. Visits will also be arranged to the many industrial establishments and to the new municipal drainage plant.

The symposium to be held under the auspices of Section K on the subject of yellow fever and other insect-borne diseases is attracting much attention, and many prominent experts have accepted invitations to speak. Professor Farlow, the retiring president, has announced as his subject 'The Popular Conception of a Scientific Man at the Present Day.'

On Monday evening the American Chemical Society will hold it annual subscription dinner, and the visiting members of the Sigma Xi will also hold a dinner at a time and place to be announced later. The hotels have announced reasonable rates, and a full list of these rates, together with a list of boarding houses, will be printed in the preliminary announcement.

The permanent secretary reiterates the announcement on the authority of the best sanitarians in the country that there should not be the slightest fear in the mind of any member of the association that New Orleans will be an unhealthy place at the time of the meeting or that it is now unhealthy. In fact, the brilliant sanitary achievement of last summer in wiping out the yellow fever epidemic should greatly add to the interest of a visit to New Orleans at this time. This fact and the general interest attaching to this unique city, together with the unprecedentedly low railroad rates, should combine to bring about an especially large attendance and particularly from the north and east. A visit to New Orleans and its vicinity is in many ways as interesting as a visit to France or Spain.

SCIENTIFIC NOTES AND NEWS.

DR. WILLIAM M. L. COPLIN, professor of pathology and bacteriology in Jefferson Med-

ical College, has been appointed director of the Department of Public Health and Charities of Philadelphia.

On Charter Day, November 10, Rutgers College conferred the honorary degree of doctor of science upon Professor John E. Hill, head of the department of civil engineering at Brown University.

Dr. Friedjof Nansen will shortly go to London as minister from Norway.

The Ingersoll lecture at Harvard University will be given by Professor Wilhelm Ostwald, of the University of Leipzig, on December 12. The subject is 'Individuality and Immortality.'

President Remsen, of the Johns Hopkins University, gave the chief address at the inauguration of Dr. Charles Lee Smith, of Mercer University, Macon, Ga.

The various expeditions sent out by the Carnegie Museum to the fossil fields of the west have returned. The party under Mr. O. A. Peterson has collected a large amount of material from the Miocene deposits of Nebraska. In Montana Mr. Earle Douglass and Mr. Percy E. Raymond were very successful, the former in collecting vertebrates, the latter in collecting invertebrates, and in studying the relations which the Ordovician of the west bears to that of the eastern portions of the United States. The explorations conducted by Mr. W. H. Utterback led to the discovery and collection of the greater portion of a skeleton of Brontosaurus and of the remains of some smaller dinosaurs.

Mr. R. S. Williams, who has been exploring in the Philippine Islands on behalf of the New York Botanical Garden for about two years, has returned with large collections of herbarium and museum specimens and seeds.

Dr. Wm. Bullock Clark, professor of geology at the Johns Hopkins University, delivered a public lecture on November 13 before the Woman's College of Baltimore on 'Fossils and Geological History.' He will deliver a second lecture on December 11 on 'The Mineral Resources of Maryland.'

Leave of absence for this year by the University of North Carolina has been granted to Dr. James Edward Mills, associate professor of chemistry, and to Mr. Marvin Hendrix Stacy, instructor in mathematics. Dr. Mills goes to Germany to study chemistry. Mr. Stacy will study mathematics at Cornell University.

Professor H. S. Blichfeldt, of the department of mathematics of Stanford University, who is on sabbatical leave this year and who has been studying in Paris, has gone to Berlin to continue his work.

Professor William A. Kellerman, of the Ohio State University, will start on his second annual trip to Guatemala about the middle of December, where he will continue his studies of the mycologic flora. Minor commissions of specialists will be executed gratuitously, so far as time and opportunity may permit, and requests should be sent to Dr. Kellerman at once.

The following movements among the staff of the U. S. Bureau of Plant Industry have been reported to *The Botanical Gazette:* Dr. W. O. Richtmann has returned from a trip to California, undertaken in the interests of camphor and poppy investigations; Mr. W. F. Wight has just returned from Europe, where he spent four months in studying type specimens of plants in various herbaria; Mr. F. H. Hillman recently visited the Pacific coast in order to study the species of dodder which are so troublesome in alfalfa and clover fields; Mr. G. Fred Klugh spent several months in Idaho and Nevada studying the relation of poisonous plants to the sheep trouble known as 'bighead'; Mr. S. C. Hood, who has been in charge of the Vermont station for drug-plant investigations, at Burlington, has returned to Washington for the winter; Professor H. Pittier is about to start on an exploring trip of four or five months' duration in western Columbia, with a special view to a study of the cottons of that region; Mr. T. B. Young has returned to Washington after a season's work at Ebenezer, S. C., where he has been in charge of the drug-plant farm, in cooperation with Mr. J. W. King; Mr. Edgar Brown recently returned from an inspection of the more important seed laboratories of

England, France, Netherlands, Germany, Austria-Hungary and Switzerland; Mr. W. W. Stockberger recently made a trip through the hop-producing sections of the Pacific coast and the state of New York, where the conditions of brewing and of curing hops have been studied; Dr. J. W. T. Duvel is spending some time in Ohio and Illinois investigating the curing of seed corn. It has been found that by proper treatment seed corn of high vitality can be assured at planting time.

THE Central High School of St. Louis announces a lecture course entitled 'Outlines of Human Development,' by Doctor W J McGee, director of the St. Louis Public Museum. The special topics and dates are:

November 24.—'Development of Human Structures and Functions.'

December 1.—'Racial and Inter-racial Development.'

December 8.—'Development of Mentality and Collective Activity.'

December 15.—'Essentials of Social or Demotic Development.'

January 5.—'Development of Laws and Institutions.'

January 12.—'Development of Primitive Arts and Industries.'

January 19.—'Higher Esthetic and Industrial Development.'

January 26.—'Development of Language and Literature.'

February 2.—'Development of Philosophy.'

February 9.—'Conjoint Development of Science and the Broader Humanities.'

The course was arranged by Miss Amelia C. Fruchte and Principal W. J. S. Bryan, of the Central High School.

AT the monthly general meeting of the Zoological Society of London, held on November 14, the Duke of Bedford, president, in the chair, the report of the council for the months of August, September and October was read by the secretary, Dr. P. Chalmers Mitchell, in which it was stated that during those three months 893 additions had been made to the society's menagerie, viz., 288 had been acquired by presentation, 142 by purchase, 280 had been received on deposit, 72 by exchange, and 111 had been bred in the gardens. The report further stated that the number of visitors to the society's gardens during the months of August, September and October had been 263,440, showing an increase of 6,810 on the number for the corresponding period of the previous year. The meeting then adjourned to December 21.

UNIVERSITY AND EDUCATIONAL NEWS.

THE *Harvard Graduate Magazine* for December contains an article by Mr. J. D. Greene, the secretary of the university, on the endowment fund for increase of salaries, from which it appears that the fund amounts to nearly $2,300,000. The scale of salaries is to be as follows:

Instructors:	
Upon appointment	$1,200
Yearly increase	100
Maximum	1,500
Assistant Professors:	
In the first five-year term	2,500
In the second five-year term	3,000
Associate Professors:	
Upon appointment	3,500
Maximum	4,500
Professors:	
Upon appointment	4,000
Maximum	5,500

MRS. PHOEBE HEARST has presented to the California State University her archeological and anthropological collection from all parts of the world. It has cost over $400,000, and with it she presents to the university $60,000 for the maintenance of a department of anthropology.

HOPE COLLEGE, Holland, Mich., recently received $100,000 from Mr. Ralph Vorhees, of Clinton, N. J., $35,000 to be used in the erection of a woman's dormitory and the remainder to be added to the endowment fund.

A NEW chemistry hall has been erected for the University of North Carolina by a legislative appropriation of $50,000.

A BOARD of regents of the University of California has purchased the Bancroft Library. The purchase price was $250,000, of which amount H. H. Bancroft gave $100,000.

THE medical department of the University of Vermont, occupied for the first time, on

December 2, the building erected to replace the old structure, which was burned in 1904. The new building cost $100,000. The principal address at the opening exercises was delivered by Dr. John B. Grout, superintendent of the State Insane Hospital, at Waterbury.

Mrs. Clara C. Jacobus has given $25,000 to found a fellowship at Princeton University, to be conferred on the graduate student who has reached the highest excellence in his work during the previous year. An anonymous donor has given $10,000 to establish a fellowship in chemistry.

Mr. Henry B. Loomis of the class of '75 has given $10,000 to the Scientific School of Yale University to establish a fellowship in chemistry.

Mr. W. D. D. Crotch, M.A., of Asgard, Richmond, Surrey, bequeathed the residue of his personal estate after the termination of two life estates on trust for the museum of zoology at Cambridge, the interest to be set apart to form a fund for the purchase of books or specimens. The present value of the residuary estate has been ascertained to be about £8,000.

Lord Onslow, on November 18, opened the new museum and laboratories of zoology which have been erected at a cost of £18,000 in connection with the work of the University of Liverpool.

The library of the late John Stuart Mill has been presented to Somerville College for Women, Oxford, by Miss Helen Taylor. It contains about 2,500 volumes.

Mr. J. Martin White has offered to pay the expenses of a series of lectures in London University on Japanese education. With the aid of the Japanese minister at London, the university has completed arrangements with the Japanese government for the delivery of the lectures during the summer and autumn terms of 1906. The lecturer appointed by the Japanese government is Mr. Masataro Sawayanagi, director of the General Education Bureau in the Department of Education. He will probably deliver courses on the methods of Japanese home and school education, especially with reference to Japanese sociology, and also a course on Japanese methods of educational organization and administration.

The London *Times* states that in 1899 the Witwatersrand Council of Education raised a sum amounting to £100,000 for the purpose of providing elementary education for the Uitlander community. This money, which now amounts to about £115,000, has remained intact until the present time, with the exception of a portion of the interest which has been given to the Transvaal Technical Institute. At a meeting of the trustees it was decided to dispose of the fund in the following manner: £60,000 to the Technical Institute and £30,000 to found a public school at Frankenwald more or less on the lines of an English public school. The balance of £25,000 will probably be divided between Jeppestown High School and Johannesburg College, but is held over pending the report of the government commission on secondary education.

The graduate department of the University of Cincinnati has been reorganized with the title of graduate school. Its faculty consists of the heads of departments, with Professor Merrick Whitcon.b of the department of history as chairman.

Nearly sixty students, who are members of the senior class in the Yale Forestry School, have left for the woods of northern Maine. They will spend the next two months in observing practical forestry and commercial lumbering work by the companies who conduct logging camps.

Dr. William Louis Poteat, formerly professor of zoology, was installed as president of Wake Forest College on December 7.

Mr. W. M. Barrows has been appointed Austin teaching fellow of zoology at Harvard University.

Dr. E. W. MacBride, Strathcona professor of zoology at McGill University, has been appointed examiner for the natural science tripos at Cambridge University.

Dr. W. A. Bowne, F.R.S., has been appointed professor of applied chemistry at the University of Leeds.